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ABSTRACT

In addition to annotated bibliographic references to 489 current United States and foreign publications on science (including technology and engineering) policy, four articles are included in this issue of this quarterly publication. In the first article, a former President of the National Academy of Sciences makes some observations and predictions about changes in public attitudes and their consequences; Battelle's president presents an exposition of the role of engineering in ". . . rectifying the deteriorating international economic position of the U. S." in the second article. The third discusses factors governing productivity--"its role as a 'quality of life' determinant; and in the last article, the new Director of the National Science Foundation (NSF) sees the missions of science and the NSF for the immediate future. (LK)

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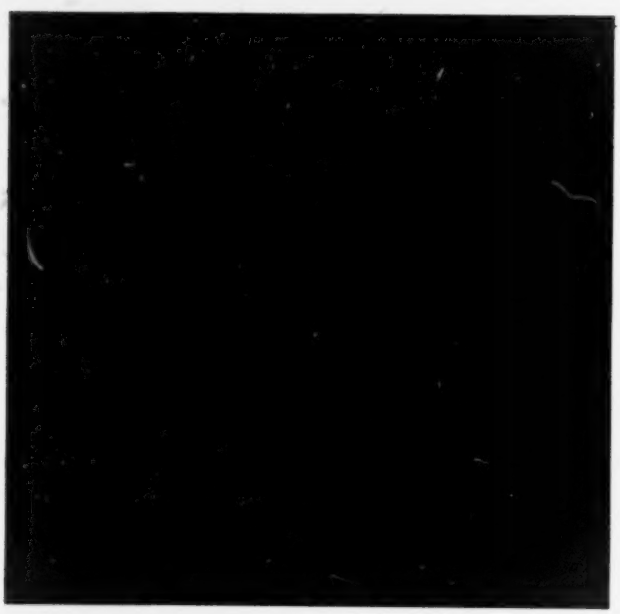

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Volume 5/Number 2/1972

Managing Editor, Clyde R. Tipton, Jr.; Editor, Eugene M. Simons; Assistant Editor, Dorothy J. Wallace; Circulation, L. Judith Sellers

Science Policy Reviews is a current-awareness journal designed for persons interested in the interactions of public policy with science and technology. Its contents are of two types: (1) feature articles in the form of invited papers, commentaries, speeches, reviews of timely topics, or reprints of particularly significant articles published elsewhere and (2) annotated reference to recent books, reports, news releases, brochures, and periodical literature (see list on last pages).

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About This Issue

Publishing a current-awareness journal on such an all-enveloping subject as science policy is difficult in some respects and easy in others – difficult because the very broadness of scope makes it hard to do justice to the overwhelming volume of literature, and easy because there's never a lack of subject matter of wide interest to highlight.

This issue of *SPR* illustrates my point very well. There are 79 different subject categories in the Current Literature section, ranging from Alaska Pipeline to West Germany. Two of the four feature articles deal rather extensively with the interaction of economics with science and technology – an area touched on only lightly in previous issues of *SPR*.

On a different subject, I remind you that *SPR* and its predecessor, *Science Policy Bulletin*, are available in microfiche form from Columbus Microfilm Incorporated, 3167 Cleveland Avenue, Columbus, Ohio 43224, and in microfilm and enlarged reproduction form from University Microfilms, Ann Arbor, Michigan 48106. We hope these two sources will be useful to librarians and to many of you who have requested back issues, which regrettably we are unable to provide. / C. R. Tipton, Jr.

Attitudes of Society

Rockefeller University President Frederick Seitz was the featured speaker at Battelle's Science Policy Colloquium in May. His frank discourse includes thoughtful comments on the public's historically ambivalent attitude toward pure science and its current misgivings about the benefits of technology, the revolutionary boiling up and simmering down of the intellectual community, and the relaxation in moral standards.

Dr. Seitz makes some interesting predictions related to these changes. For example, he expects "substantial reversion to more traditional [moral] values", a power crisis in this decade that will cause a "public reappraisal of constraints" on new power plants, and public pressure on professional communities to tackle the immediate problems of society.

In the belief that SPR readers will find Dr. Seitz's remarks as thought-provoking as the Colloquium attendees did, we present his text below.

REFLECTIONS ON THE RELATIONSHIPS BETWEEN SCIENCE AND TECHNOLOGY AND SOCIETY

by Frederick Seitz

Perils of Prediction

I would like to take this special opportunity to express some rather personal views concerning the relationships between science and technology and the society in which we live. In doing this, I shall emphasize the transitory nature of the present state of affairs and attempt to forecast the future, although I have very modest claims to being a futurologist. It is popular in these days of Forrester, Meadows, and the Club of Rome to attempt to use computers to forecast the grand sweep of coming events. I have great respect for such endeavors as symbolic guides and I encourage careful work on such models as one component of our efforts to form wise public policy.

But folly and limited vision, as well as accident, play such important roles in human affairs that no one should take a particular forecast, including my own, too seriously. For example, would anyone using mathematical analysis at the turn of the century have guessed that western Europe would be playing so much of a secondary role on the world stage as it is now? The folly which caused the European nations to encourage the rivalries that led to World War I can scarcely be fed into a computer. In dealing with such variables, philosophers and poets would seem to be as effective judges of the future as analytical scientists are.

The Status of Science

The relationship between science and our own society has always been complex — never too well understood either by the public or by the scientific community. The public has tended to be ambivalent in its appraisal of science, undervaluing it most of the time and occasionally overvaluing it. The scientists have alternated between looking upon themselves as under-appreciated paupers and rating themselves as enlightened super-beings. Our domestic situation contrasts to that of Europe where science has had a far more central and prominent position in both the cultural and technological domains and has also been better understood by both.

Ever since the 13th century, when Europe became aware that it might be possible to extend man's knowledge of the natural world through systematic measurement, science has been a central issue, publicly discussed and publicly debated. European scientists have been taken sufficiently seriously as to be occasionally singled out for persecution as heretics as well as honored for imaginative innovations. In contrast, the worst offense our own society has offered to the scientific community is to ignore and possibly ridicule it. At present, the process of ignoring science involves the cutting back of funds for basic

research and for new posts in academic institutions.

The Status of Technology

Until the last few years the attitude of our nation toward technology has been quite different from that toward science. From colonial times onward we have prized the technical innovator, whether in the field of engineering, medicine, or agriculture. Robert Fulton, Eli Whitney, and Thomas Edison were national heroes during their own lifetimes, whereas, until well into this century, the only scientist who was widely appreciated was Benjamin Franklin, whose popular fame rested only in a secondary way upon his brilliant scientific work. We took the sponsoring of creative scientific work in our own country really seriously only toward the beginning of this century when the chemical and electrical industries became so highly developed that they could no longer rely exclusively on European discoveries if they were to assume positions of leadership.

The Bush Report

The great outpouring of public wealth in support of science, which started in 1940 and grew continuously until recently, stemmed from the expectation that the support of basic science in peacetime would be no less revolutionary in its practical consequences than the support given to scientists in World War II. It is interesting to reread the report of the Bush Committee prepared in 1944 under the title, "Science, the Endless Frontier." It is clear that when Vannevar Bush and his colleagues advocated continuing strong support of science after the war, they did so with the implicit expectation that the scientific community while retaining independence would remain closely linked in attitude to what is called the Establishment. They apparently assumed that the spirit of national unity which prevailed during World War II (when the great majority of scientists were willing to walk pretty much in lock-step with the Federal Government) would persist long into the future, so that the work of the basic scientists supporting the Federal Government could be transferred to applications endorsed by that Government without significant impediments.

One detects no premonition that MIT, for example, might become the scene of an event as dramatic as the talk-in of March 4, 1970, in which a significant part of the scientific community would urge its colleagues to form judgments concerning the uses of science which might, on occasion, be in dissonance with those of the elected officials of the Republic and, in fact, represent the voice of what one might term a fifth estate. In any case, it was clear by 1970 that the premises on which the Bush report had been founded were due for serious reexamination.

Social Ferment

My mention of scientist talk-ins brings me to an issue much broader than the relationship of science to society; namely, to an examination of the pattern of values within our society, particularly the way in which these values affect the intellectual community of which the scientific community is a part. Now that violence and related unrest have subsided somewhat on our campuses and we enter into an era of at least limited stability, it is evident that the ferment within the intellectual community in recent years has resulted in a significant loosening of the bonds which tie our society together and govern the working relationships between its various components.

I was born in 1911 and do not recall any time, until the past few years, in which one might have expected to become significantly unpopular with one's colleagues because one cooperated with the properly elected government on its terms. It is true that our country was almost torn in two during the period of stresses which preceded and led to the Civil War. However, the fact that the tensions then led to a war demonstrated that the polarization could in the main be resolved into specific antagonistic components. The current situation is far more diffuse since the differences in viewpoints are numerous.

To borrow a chemist's term, one might say that some of the resolvable structure of our society has gone into solution in recent years and is awaiting new issues about which to condense or crystallize. The process of solution is by no means as complete as that which took place in France or Russia during the revolutions of 1789 or 1917 and which, as we know, was ultimately resolved in both cases by the creation of autocratic governments under strong dictators. But it has gone so far that many traditional institutions which were highly influential in the past cannot or do not now function very effectively as instruments of the Establishment. For example, one notes that the American Legion, which once symbolized traditional patriotism, is held in open disrepute by a significant component of the intellectual community. Similarly, the police are reviled as never before in my own lifetime.

In another direction, we note that my favorite newspaper, the good gray *New York Times*, seems, at least to me, to suffer from a form of schizophrenia peculiar to our time. On the one hand, it remains a significant window on the world of private enterprise of which it is a part; on the other, it seems to espouse the view that adverse criticism of existing institutions is far more important than the type of constructive criticism which can lead to the formulation of new and more effective institutions. In the latter sense, it seems to emulate the spirit of the youthful intellectuals who abound on our campuses and to whom I, as a university president, listen as intently as I possibly can these days for occasional bits of constructive guidance.

Uncertainty in Professional Societies

At a closer range, those of us in the scientific community see many of the traditional professional societies caught up in crosscurrents between those who would preserve their long accepted role of establishing high professional standards and disseminating scientific information, and those who would like to use the societies as platforms for reviewing the ills of society, including such matters as unemployment, with the hope they may be able to propose cures. I await with much interest the rash of *ad hoc* political organizations which will spring from the membership of the professional societies during the forthcoming national election, to see if the scale of this activity is still growing as it has been for the last decade or so.

It remains to be seen if such illustrious organizations as the American Chemical Society and the American Physical Society will be able to preserve their initial purpose of serving their membership and society as a whole exclusively through a political professional scholarship and related matters, or whether they will become instruments in the hands of politically motivated individuals. Even the National Academy of Sciences which is linked to the Federal Government by a Federal charter which requests that it render advice to the Federal Government on request is involved in serious debate concerning the conditions under which it actually will be willing to be responsive to its government. It is true that the Academy experienced a somewhat similar period in the mid-1930s because some of its members were unsympathetic to President Roosevelt's New Deal. However, not only was the period of doubt then relatively short but the Academy at that phase of its existence did not occupy the central role that it does at present, so that the issue was not as practically significant as at present.

The Leveling Off

Fortunately, the processes leading to the disruption or dissolution of old patterns of allegiance and behavior seem to be leveling off. Presumably, a number of factors are involved. These include disillusionment at how slowly positive results can be realized from violent protest as well as the knowledge that the academic economy can be seriously dislocated by public reaction to violent protest. One notes, for example, that many more of the advanced students, presumably destined to be the leaders of the future, though still lamenting what they regard to be the ills of society, now wish to prepare themselves to take constructive

action within the system, and, as a result, are now ready to take their own formal education quite seriously.

In view of this trend, it appears that the consequences of the recent revolutionary movement will be limited and not very radical in nature. In attempting an analysis of the limits, one assumes, of course, that unforeseen events will not produce a significant perturbation in the scheme of things. Let me attempt to examine this theme further.

Middle-Class Standards

To leap ahead by way of a preliminary summary, if I were asked to give a single reason for the optimism which leads me to say that the revolutionary ferment in the intellectual community in our country has flattened off, and actually will subside, I would say that it stems from a realization that our nation remains dedicated to middle-class values, as has been the case since early colonial days. The period of violence and turmoil in the intellectual community which reached its peak in 1970 was led by small groups of hard-core radicals and followed by many middle-of-the-road individuals who were not fully aware how their own actions could adversely affect their opportunities in the future. Regardless of how lofty their ideals may have been, most of the activists suffered from short-range vision. Now that it has become clearer to this middle-of-the-road group that the goals sought by the radicals actually would narrow rather than broaden their freedom and opportunities to play a part in society, they have decided to work *within* rather than *without* the system in effecting significant changes.

Break with Traditional Moral Codes

One of the most striking changes which has occurred in recent years, particularly among the young, is the distinct break in the traditional moral codes which have guided our nation for so long. While I do not expect a complete return to the past, I am inclined to believe that there will be substantial reversion to more traditional values. Many of the older moral codes were based on practical grounds. Sexual promiscuity faces the hazards of venereal disease which, as you know, is now increasing in its more obdurate forms. The child of the working mother without a husband in the family unit has, on the average, greater problems to overcome than a child raised in a more conventional family. Only a relatively well-to-do woman will prefer to rear a fatherless child. Practical issues will restore more nearly traditional standards, as ultimately happened in England following the loosening of the moral codes that accompanied the demise of puritanism.

This is not to say that there will not be substantial permanent changes such as the continued success of women's drive to obtain more nearly equal status within our American society – as is in fact the case in most of Europe. I would be inclined to regard the successes of the women's liberation movement as a normal part of the industrial revolution whose social aspects have in some ways developed more slowly in our country than elsewhere.

Adjustment of Industry

It also seems clear, at least to me, that American industry will prove equal to the problem of adjusting to the stresses it encounters as a result of the ferment within the intellectual community. The structure of boards of directors will be examined and modified without seriously affecting the ability of boards to function. Regulations concerning pollution will be expanded and strengthened, as they have from time to time throughout this century, but industry will regain its equilibrium, since its output is far too important to the welfare of the country to be placed in eclipse.

The power industry obviously faces special problems since there are so many forces at work at present, seeking to prevent the extension of the national power grid. This issue will probably reach crisis proportions in some parts of the country in the present decade and lead to a public reappraisal of constraints which will permit continued expansion of the grid. As many of you know, New York City came very close to losing much of its air conditioning last

summer when Consolidated Edison struggled with the maintenance of one of its major generators. A few collapses of regional power grids through overloading will place the matter of new power plants in a rather different perspective than is the case when one is on the surplus side of supply and local breakdowns can easily be compensated for.

I do not believe that our country is ready to forego the advantages of access to cheap and plentiful electric power. The time is near at hand when it would be far wiser and more effective for the environmental groups to work with the power companies in resolving their problems rather than to persist in single-purposed opposition.

It is also worth emphasizing that the costs of environmental control, necessary as such control is, will inevitably be passed on to the consumer in higher prices. Unless the environmental groups begin working within the framework of our political-economic system, they will run the great risk of losing consumer endorsement.

Public Expectations

As a result of its current loss of enthusiasm for the support of pure science, the public will place pressure on the professional communities to tackle a number of problems which it looks upon as having immediate practical importance. We will be asked to devote our energies to cancer, heart disease, pollution, transportation, housing; and, at the same time, will be concerned with national and international patterns affecting trade and employment levels. The Manhattan District and the Apollo program will be used as models for harnessing the energies of the appropriate professional groups, including the scientists.

Many will respond to these challenges. I understand, for example, that bales of applications have been received in response to the national cancer program. Yet the scientific community must be utterly realistic in assessing its abilities to respond to these challenges for fear of encountering a strong adverse reaction if its promises, implicit as well as explicit, should turn out to have been excessive.

Many of us vividly recall that in the mid-fifties the Atomic Energy Commission sent out an appeal to the scientific community to seek solutions to the problem of controlled fusion. When, a few years later, it became evident that the solution of the problem – which a segment of the scientific community had led the Commission to believe was imminent – actually was several decades away, the public reaction was pronounced. Funds were cut back to levels substantially below those needed for a really viable program. As a result, the field of controlled fusion has struggled along at a bare subsistence level in our country ever since. It behooves the scientific community to be temperate in its promises of practical results and to take its responsibilities in guiding such programs with the utmost seriousness.

The Creative Centers

Let me now narrow my attention to four areas of primary importance for the advancement of science and technology in our society; namely, the academic institutions, industrial research laboratories, free-standing research institutes both commercial and nonprofit, and the Federal research establishments.

(1) THE ACADEMIC INSTITUTIONS

The typical academic institution devoted to higher education is today the arena for a two-sided struggle with which it will probably be forced to contend for many years. The conflict is over the question of whether the university should become primarily what someone has called a "youth city" in which the short-range interests of its youthful residents determine policy; or, whether the university should focus instead on professionalism as has been the evolutionary trend through so much of this century. In other words, should the typical faculty member devote primary attention to the pursuit of scholarly professional goals or should such activities be secondary to that of tutoring the students, basically on their terms? The forces at work against the advancement of professionalism at the present time are so strong, particularly in these days in which higher education has

become so popular, that it seems obvious to me that we will be fortunate if we are able to maintain the present level of professional quality in our colleges and universities.

A decade or so ago, when I was at one of the major state universities, I had strong hopes that institutions such as the University of California at Berkeley – which was looked upon widely for leadership among state-supported institutions – would emerge as primarily graduate universities and carry the evolution of professional education in our country to its logical conclusion, namely, the separation of graduate and undergraduate institutions. My friends in the California system tell me that this is impossible at present. Incidental to this, there is strong resistance generated by undergraduate students in institutions such as the University of California at Santa Cruz, which does not yet have graduate work, to the institution of a graduate program. Some present-day students regard the presence of advanced professional work as inimicable to their immediate interests and would like to curtail the State's support of graduate education.

While most elite private universities could, in principle, resist such populist pressure, the financial constraints they face are probably too great to expect the further advance of professionalism in the near future. Most alumni are emotionally linked to undergraduate traditions and will, at best, support the *status quo*.

Technically oriented institutions such as MIT and Caltech will probably have the greatest freedom of action as student unrest abates, although even they will be constrained by financial limitations. Fortunately, they have the choice of populating their undergraduate programs, in the main, with students who have long-range professional ambitions and who will be sympathetic to the support of professional education of high quality, including graduate work. Thus the technically oriented institutions are in a position to reinforce rather than undermine elitism through their undergraduate programs if they choose. The opportunities and rewards will be great for those institutions which do present strong attitudes toward professionalism.

(2) INDUSTRIAL RESEARCH

It is hardly necessary to emphasize here that the health of industrial research and development is vital to the welfare of the nation, particularly if we are to remain competitive in world markets. During the last 10 or 15 years many industrial organizations have had serious doubts about the profitability of research and development, particularly that carried out on the freer and more basic side. These doubts arise in part from worries about cash flow and about profits after taxes, but also from the rising costs of research and the difficulty of obtaining staff of high quality in competition with the universities.

I am inclined to believe that the situation industry has faced in the recent past will reverse in the future. The need to renew products in the face of stiff foreign competition will compel those industries which intend to remain competitive in the technically advanced fields to reemphasize basic research, albeit with applications strongly in mind. Moreover, the saturation of academic markets and the leveling off of college enrollments and of Federal grants will place industry in a good competitive position for creative talent.

Fortunately, the importance of technology for the national well-being is now sufficiently recognized at the highest levels of government for us to anticipate growing Federal encouragement of industrial programs in support of new technology.

(3) FREE-STANDING RESEARCH CENTERS

At this time it seems particularly appropriate to reemphasize the role of free-standing research centers, whether of the profit or nonprofit types. Prior to World War II, centers such as the Mellon Institute and Battelle Memorial Institute occupied a unique position in the research structure of the nation. They undertook programs

which were inappropriate for universities and complementary to those of industry.

In the period between 1940 and 1965, jurisdictional lines became somewhat confused because both academic and industrial institutions expanded their scope of interests almost without limit. However, now that universities are returning to more traditional channels and industrial research is becoming more closely focussed on product lines, I believe that the unique importance of the free-standing research centers will become evident once more. Their strength will rest upon the fact that they have full-time professional staffs – established in an interdisciplinary setting – who will be able to devote attention to a wide range of interdisciplinary problems inappropriate for either the universities or industrial organizations under present circumstances. Their activities may range from bench research on highly technical problems to so-called societal problems, including matters such as ecological balance and the position of the under-privileged.

Congress has from time to time raised questions about such free-standing institutions, particularly those funded by the Government. However, in each case, the institutions have won support once their special role was clearly understood.

(4) FEDERAL RESEARCH CENTERS

The Federal research center, whether managed in-house or through contract, is now so well established and useful that it has earned a permanent place in the spectrum of institutions. One need only mention the National Bureau of Standards, the Naval Research Laboratory, the in-house laboratories of the National Institutes of Health, Los Alamos, and the NASA centers, to realize what an indispensable role such laboratories play. I do not believe that this system of research centers will contract. They are more likely to become even more highly prized by their sponsors as the roles of the universities and industrial laboratories become more specialized. I even dare to hope that a broad-missioned institution such as the National Bureau of Standards will ultimately grow significantly in importance.

Perhaps the most critical question at this time is whether new centers will be established as the problems faced by the Federal Government and agencies grow. The present environment is not a favorable one for the establishment of new Federal research centers. For the moment, our society is not sufficiently buoyant to surmount the barriers needed to take on imaginative new ventures. It is much more likely that existing centers will be remodeled and given new missions as well as extended in scope – a process which can occur only slowly. On the other hand, as I have already noted, this is a particularly good climate for existing free-standing research centers to expand their role.

There is one possible exception to my appraisal of the prospects for new Federal centers. The growing problems faced by the regulatory agencies, such as the Food and Drug Administration, may indeed require the establishment of completely new in-house research centers. Since there is now increased and widespread concern about protection of the consumer, it may be possible in this case to circumvent the barriers which would otherwise impede the creation of new laboratories.

Technology

As I commented earlier, we are now passing through a period in which it is a common practice for intellectuals to question the role of technology in our society. Opinions range from a healthy concern about the need to expand the role of technology to include studies of its detrimental effects and the associated remedies, to the opposing view that technological innovation is a cancer-like evil which should be halted if not actually reversed. It is my present opinion that the second of these attitudes will be overwhelmed by the former as it becomes clear that our present system of values cannot be preserved without technological innovations.

This is not to say that technology will ever

again run as completely unbridled as it did when we were a nation with a seemingly endless geographical frontier and unlimited natural resources. However, I find it difficult to believe that the majority of our citizens will find it advantageous to follow in the footsteps of the extremists, once the price of so doing is clearly understood. In fact, we are probably very close to the turning point in which the dissenters will find it more profitable to exert their influence within the framework of ongoing society rather than outside it. When this occurs, the subject of "technological assessment", which has been a catchword having different meanings for different groups, will take on a more unified constructive meaning.

Pure Science

My own professional roots lie in the pursuit of science for its own sake – in the search for deeper understanding of the natural world in which we live. I regret to say that in the foreseeable future, I believe our society will have only marginal interest in the advance of such basic science, even though it is undoubtedly true that the national well-being would, in the long run, be best served by sponsoring most of the good research that the competent scientists can envisage. It is not merely that our society is far too concerned with other problems, but, more importantly, we do not at the moment have a peer group of scientists – analogous, if you will, to Bush, Conant, and the Comptons – who, while speaking for science, also speak for the common interest of our society. Those prominent scientists in academic life who have opted for what I term "petit maoism" have become sufficiently conspicuous that the public at large is no longer prepared to sacrifice its means for them on their terms. The New York City taxi driver, who is the ultimate pragmatist of our day, takes a neutral view on the support of pure science, and most of our fellow citizens feel much as he does.

There is, however, hope that times will change. My astronomer friends tell me that lectures on the universe and unsolved problems of cosmology are well attended these days, as they have been for a long while, so there remains a love of basic knowledge, born of human curiosity, that only science can fulfill.

Engineering a Sounder Economy

A firm believer in the power of science and technology to cure ills of society, Battelle's President Dr. Sherwood L. Fawcett applies the engineering approach to the ailing U.S. economic situation. He analyzes the problem, defines its boundary conditions, reviews potential solutions and available resources, and discusses the key role that engineering must play.

This fascinating exposition was the principal address at The Ohio State University's Annual Conference for Engineers and Architects in May. It is presented below for the enjoyment of SPR's readers.

ENGINEERING TO THE RESCUE – SO WHAT'S NEW?

by Sherwood L. Fawcett

Introduction

It is both an honor and a distinct pleasure to talk with you today about engineering. As you perhaps noted from the program, I am directing my remarks to our economy and the role of engineering in it. Certainly, this subject is both compelling and current. As all of you know, there has been a sequence of events, beginning last August, that has underscored our economic problems. At that time President Nixon took dramatic action by freezing wages and prices and applying a surtax on imported goods. This action shook the governments of the Free World to their economic roots and raised a series of monetary and economic questions concerning the value of the dollar abroad and the price of American goods. Fortunately, I believe, it also led us, as a nation, to look more closely at the role of science and technology in our economic life.

The President pointed out in his January, 1972, State of the Union message that the nation has a special bent for science and technology and announced that he was evolving a long-term strategy by which the Federal Government can work as a more effective partner in the utilization of technology.

On March 16, 1972, he delivered before Congress a truly historic message – the first Presidential message ever on science and technology. In that address the President called for a strategy based upon the following elements:

a. The maintenance of strong, sensible research and development programs in space and defense,
b. The application of our scientific and technological genius to domestic opportunities,
c. The stimulation of the processes of research and development through both private and public sources – processes which admittedly we do not fully understand,
d. The employment of our technologically oriented agencies in support of agencies with social missions, and
e. The focusing of our resources on clear research targets where breakthroughs are most likely.

The President backed up his message with a request for $17.8 billion in the fiscal year 1973 budget for research and development – an increase of $1.4 billion, or more than 8 percent, over fiscal year '72.

In his unprecedented message, President Nixon praised research scientists and engineers for their great achievements of the past – in space, medicine, industrial productivity, and defense. Looking to the future, however, he said (and I quote) "the accomplishments of the past are not something we can rest on, they are something we must build on. I am, therefore, calling today for a stronger effort to marshall science and technology in the work of strengthening our economy and improving the quality of life, and I am outlining ways in which the Federal Government can work as a more effective partner in this great task." (end quote)

If you put all of these statements and

actions together, it's clear, to say the least, that something significant has been happening in our economic affairs, and the President is counting heavily on engineers and technologists to make right whatever is wrong with our country. Engineers are being sent to the rescue of something!

For an engineer, problems are his thing and solving them is his career. So, let's approach this national problem – our economic affairs and the role of technology – from the viewpoint of an engineer. As engineers, let's ask the classic questions of our profession:

1. What's the problem?
2. What are the boundary conditions of the problem?
3. What are the potential solutions, and, in fact, is there a solution?
4. What are the resources available for solution?
5. What is the best or optimum solution?

As engineers, from these basic questions we will develop a plan of action, and in this particular case, we'll add one more question: what is the role of engineering in this plan?

The Problem

Now to the first question – what's the problem? The surest answer we can give is that it's big and complex and we need to study the background of the problem so as to be better able to examine solutions. And recognizing our own limitations, let's turn, for background, to the study "The United States in a Changing World Economy", prepared by Mr. Peter G. Peterson, who is now the President's Secretary of Commerce. The data from which I'm drawing were prepared for briefings to the President and the Council on International Economic Policy during 1971.

POSITION STATEMENT

The data indicate that, while the U.S. national economy has remained basically strong, our *international* competitive position has deteriorated alarmingly. Our balance-of-payments deficits have risen sharply and our competitors have become relatively much stronger both economically and technologically.

THE CHANGING WORLD MARKET

Between 1950 and 1970 the combined GNP's of the trading nations of the world increased from $0.7 trillion to $3.2 trillion (1971 dollars), and world trade increased five-fold. Percentage-wise, the greatest gains over this 20-year span were made by Japan and the European Community. Next January, on adding Great Britain, Ireland, Denmark, and Norway, the European Community will represent more people than the U.S. and will have almost as large a GNP.

To background the problem, I want to indicate the general trend rather than dwell at length on the particular specific data. Hence I'll present – quickly – a number of charts to make the point.

THE CHANGING U.S. POSITION IN WORLD MARKET

In 1950, the U.S. GNP represented almost 40 percent of the gross world output (Figure 1). Today it is about 30 percent, largely because our exports have been increasing at lower rates than those of our trading partners.

Though world GNP more than doubled in the decade 1960-1970, U.S. GNP increased by only 48 percent (Figure 2); meanwhile, Japan's GNP almost tripled. Of the countries shown, only the U.K. made a poorer showing than the U.S. Similar trends are apparent in the growth of industrial production during the 1960's.

The increasing capabilities of foreign economics in both basic and high-technology industries are reflected in (among other things) the declining U.S. share of the world's automobile and steel markets over the past 20 years (Figure 3). The European Community and Russia already exceed the U.S. in steel production, and Japan is likely to surpass all three by 1975.

World exports have increased by a factor of five in the last 20 years, with the U.S. share dropping from 16 percent to 14 per-

cent (Figure 4). Meanwhile, the European Community's share almost doubled and Japan's went up by a factor of six!

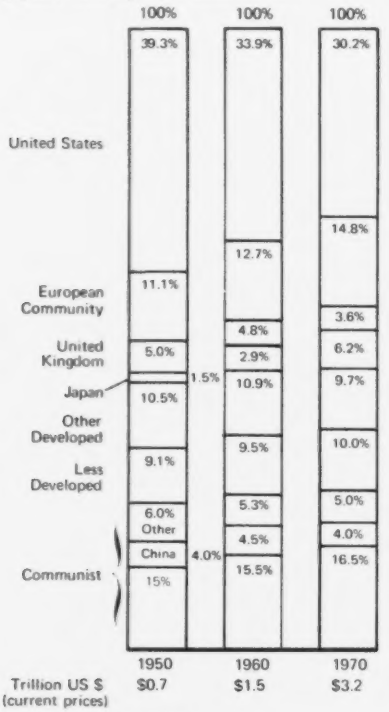


Figure 1. World GNP

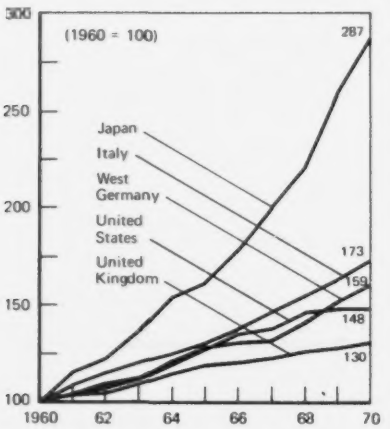


Figure 2. Index of Real GNP Growth

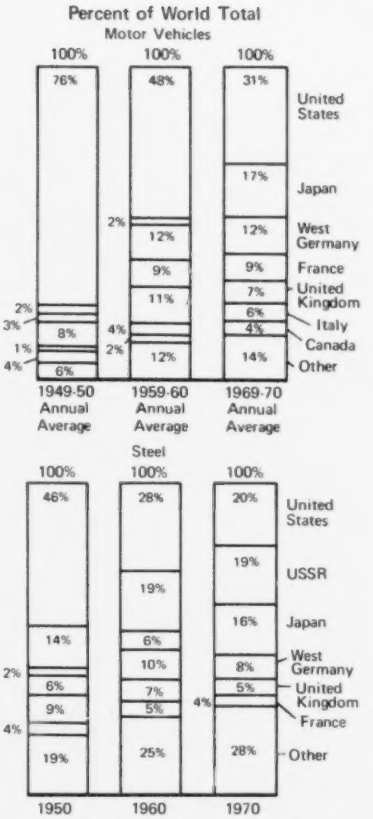
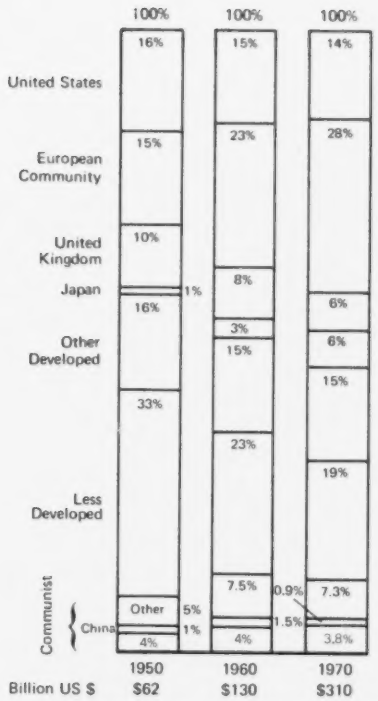


Figure 3. World Production of Motor Vehicles and Steel

During the decade of the 1960's, U.S. exports of manufactured goods increased by 110 percent (Figure 5) – a relative growth rate that was substantially below that of every industrialized trading partner except the U.K.

Meanwhile, U.S. imports were growing about 25 percent faster than exports, and finally surpassed our exports last year by about $2 billion (Figure 6). This is the first time since the late 1800's that the U.S. has had a net trade deficit.

Contributing to this deficit was a record $9.1 billion trade gap in "nontechnology-intensive" manufactured products (made of fibers, leather, paper, metals, and wood) and a $3.3 billion gap in minerals, fuels,



Exports within the European Community accounted for 31% of total EC exports in 1950; 35% in 1960; 48% in 1970. In 1970, Soviet exports to Communist countries accounted for 65% of total exports.

Figure 4. World Exports

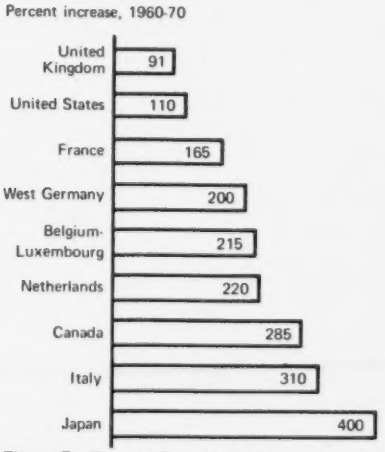


Figure 5. Export Growth in Manufactures for Selected Countries

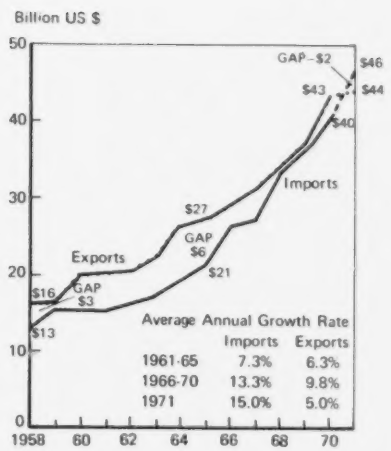


Figure 6. US Foreign Trade

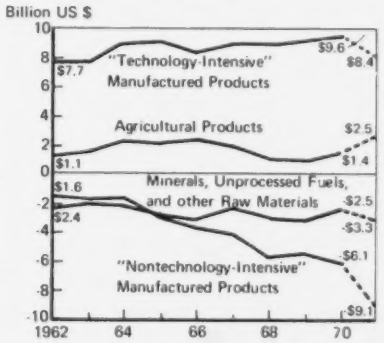


Figure 7. US Trade Balance Trends

and raw materials (Figure 7). These were not quite offset by our positive balances in "technology-intensive" manufactured products (aircraft, computers, fabricating machinery, chemicals, instruments, and such) and in agricultural products. Complicating the problem is the fact that many nations subsidize their industry and also have stiff import barriers.

Another weakening influence on our competitive position has been the growing wage costs without accompanying productivity gains. Since the mid-sixties, the average productivity gain for the U.S. has been 2.1 percent, the lowest of all major industrialized countries. Yet compensation per man-hour has increased at an average rate of

6 percent in the same period. Still, that rate is one of the lowest of the industrialized nations. So why then has the U.S. become increasingly less competitive? It cannot be explained in terms of inflation alone. Inflation in the U.S. has averaged about 4.25 percent since 1965 compared to 5.63 percent for Japan, 5.4 percent for the United Kingdom, and 4.58 percent for France. Only Germany, with 3.21 percent, and Italy, with 2.93 percent, have averaged less.

The growing disadvantage of American manufacturers can be explained by examining two factors, unit labor costs and the wage differential. Unit labor costs, the labor costs necessary to produce one unit of output, have increased at an average of 3.9 percent from 1965 to 1970 in the U.S., the largest rate of increase of all major countries with the exception of Canada. The United Kingdom and Italy's costs have increased 3.8 percent, Germany 3.2 percent, France 2.7 percent, and Japan only 0.8 percent.

The second factor, wage differentials, is probably the single most significant factor for our decreasing competitiveness. The absolute dollar per hour difference is so large that even small percentage increases from inflation or wage increases without productivity gains result in very large dollar increases in the prices of our exports. For example, Japanese workers receive approximately one-fourth as much as U.S. auto workers. The 12 percent pay-boost which Japanese employers announced recently would work out to less than 17 cents an hour, or a little more than one-half of the increase allowed by the U.S. Pay Board. It simply costs more for the U.S. to produce one unit of output than for other industrialized nations. The devaluation of the dollar was an attempt to correct these imbalances, but without productivity gains our competitive situation will not improve.

The dramatic need for increased productivity is best illustrated by what economists call opportunity costs. If productivity had continued to increase at its post-World War II trend rate of 3.2 percent after 1966, the general price level would have been almost 6 percent lower at the end of 1970 and the GNP would have been about $60 billion higher than it was. The cumulative loss in GNP over the four-year period 1966-1970 was close to $120 billion. This sum could have made a big contribution toward reversing the deterioration of the environment, financing the income maintenance program, eliminating poverty in this country, and with enough left over to have financed the completion of the SST development. Where and how can the U.S. improve productivity to its international comparative advantage?

A look at the trends in the structure of the U.S. economy provides the insight for the solution to this problem. Since 1947, employment in the Service Sector has grown 89 percent to provide 60 percent of all non-agricultural jobs, while manufacturing grew only 29 percent and provides 28 percent of all non-agricultural jobs. All goods, including non-exportable construction and inventory changes, has decreased from 69 percent to 58.0 percent of GNP (Figure 8), while services has grown from 31 percent to 42 percent of GNP in 1970.

With the declining economic base for exportable products, the obvious answer to improving our comparative advantage in world trade would be to emphasize those areas where traditionally we have been strongest, developing new, high-technology products which yield large productivity gains. Instead, we hear new cries for protectionist legislation for those industries technologically obsolete, new restrictions for capital investments, and reductions in research and development. After a long-term trend of increasing research and development expenditures as a percent of GNP from 0.24 percent in 1929 to 3 percent in 1966, research and development began to decline continuously to 2.8 percent in 1969, 2.7 percent in 1970, and 2.6 percent in 1971.

Because of these cutbacks, the U.S. has fallen behind other nations in key areas of basic research, as well as the development of high-technology products. Since 1955, the U.S. average annual loss in its share of world exports of high-technology products

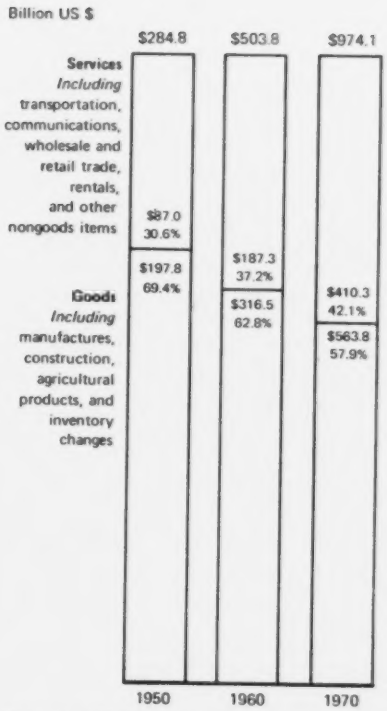


Figure 8. US GNP: Goods vs Services

has been 11 percent. In the same period, Japan has gained an average of 6 percent annually, Italy 3.8 percent, Germany 3 percent, and Canada 2 percent. It is clear then that in high-technology products with rapid potential for growth, where the U.S. has long maintained a technological lead, we find a downturn in investment, share of world exports, and productivity.

The policy of the future, then, should be to recognize the potential that now exists in the areas of capital investment, research and development, and management skill. The U.S. is a highly-developed, sophisticated country enjoying an ever-increasing standard of hiring. As such, our resources are too valuable to use inefficiently. Instead, our efforts should concentrate in those areas that are efficiently developed only by such an advanced economy. For example, concern for the environment may reduce output per man-hour, but it will also increase our standard of living. Hence, when other nations reach the stage of development we are now enjoying, we will have a new, ready-made, exportable technology. The same holds for management techniques in implementing the technological changes and capital for financing them. Now is the time to invest in research and development if the U.S. is to remain competitive and a world leader.

The Boundary Conditions

Now that we have a feeling for the problem, let us outline the boundary conditions.

CAPITAL PLANT

One boundary condition is the capital plant available to produce the goods we need and those to sell in the world market. The state of our capital plant, namely the machinery of our factories, has much to do with the efficiency with which we conduct our business. How to update this equipment is important, as is its stage of write-off. Both are of major significance because the willingness of our industrial management to undertake new things, to begin production of new items, is dependent upon what losses will be incurred in writing off or scrapping an old plant. The rate of write-off of plant and equipment is much more a function of the Internal Revenue Service and of management than it is of the engineer. However, as engineers we need to recognize that in some cases part of our problem and its solution hinges upon our ability to use an existing plant or to modify it for increasing productivity.

The Attitudes of the Work Force

Another boundary condition that must be recognized is the American work force – which includes you and me. We are aggressive, we are competitive, and we like high wages. Further, we have a rather fundamental belief that every day we are worth a little bit more than we were yesterday and therefore we should be paid more. Additionally, we believe that no one else is worth as much as we are, and as a consequence our salaries should rise but nobody

else's should, neither should the cost of products and services rise. We are perfectly willing to band together and become an economic force to attain this goal – we call this collective bargaining. While you and I may think that our American workforce attitudes are normal, we should not hasten to the conclusion that they exist worldwide. If you characterized the attitudes of the Korean, the Brazilian, or the German work force, I think you would find that they would be considerably different from ours. As engineers, we may not be able to change these attitudes, nor is their change necessarily a solution. However, we do need to recognize that the attitude of the work force is a boundary condition.

THE ATTITUDES OF CAPITAL AND MANAGEMENT

American management represents another boundary condition. It is considered to be aggressive, competitive, innovative, and shrewd. I believe this is true, but also one would have to add that other characteristics of capital and management in this country include: an unwillingness to risk or to move forward unless conditions are right, a tendency to push very hard to gain a competitive advantage, and an opportunistic attitude. Generalizations of this sort are risky, but management attitudes, nonetheless, have an important bearing on what we, as engineers, can do to improve the national economy.

THE ATTITUDES OF GOVERNMENTS

In any country, a boundary condition is the attitude of government. Fortunately, our government is presently expressing great interest in a cohesive and coordinated effort to use science and technology, capital, labor, and management to cure our economic problems. However, this attitude is tempered by a tremendous tendency toward regulation of every facet of business activity. Our government is philosophically committed to controlling the size of our business organizations. This may seem very natural to us, but if you compare events in Japan and in Europe, you will find that mergers were encouraged on the basis that they led to more efficiency and greater capability to compete in the world market. The same type of business merger would be roundly condemned in the United States as restraint of trade.

THE ATTITUDES OF THE PUBLIC

An emerging and increasingly significant boundary condition is the concern and attitude of the public with regard to business in general and the development and expansion of industry in our country. In today's idiom – consumerism. An often heard opinion is that the businessman is no longer interested in his customer. Coupled with consumerism is a belief that profit may just be a dirty word. Profit is not understood as being the necessary ingredient to capital investment. Big business is felt to be bad – even to the point that being big is bad. In this country, "the Establishment" – the label placed on the greatest organizational structure the world has known for accomplishing things in a complex society – is regarded as a liability rather than an asset.

ENVIRONMENTAL IMPROVEMENT

Coupled with consumerism and public attitudes about business in general is increased awareness that, as our population and our material wealth grow, their total effect on the environment becomes increasingly significant. We must take into account the effects of our actions on the environment. There must be a reasonable ratio of costs to benefits as we strive to minimize and eliminate environmental insults. As an example, the Office of Science and Technology recently estimated in its comparison of automotive-emission-control costs and benefits from present legislation that the total cost of the control during the decade 1976-1985 would be $95.1 billion. The benefits from this control were estimated as a maximum to be only $46.3 billion. An annualized excess of cost to benefits of about 5 to 8 billion dollars is economically significant. What the long-term public response will be to this sincere effort to

try to bring auto emissions under control can only be guessed.

QUALITY OF LIVING IMPROVEMENT

The final boundary condition that should be mentioned is so obvious that we tend, at times, to overlook it. The solution to any problem must improve the quality of life. This may seem like a very simple and elementary condition, but it is still a very necessary one. There have been solutions which literally cured the disease but killed the patient!

The Potential Elements of Solutions

Having determined our boundary conditions, we can now consider what the solution must encompass. Not surprisingly, we come up with alarmingly simple answers. In connection with the products, processes, and services having to do with our way of life, it's obvious that they must be better, less costly, more readily available to more people, and have less deleterious impact on the environment. The quality of life for people certainly must be improved. A rather "tall order", but nonetheless the one by which our degree of success will be measured.

The Resources Available for a Solution

Now, we turn to the question of what resources are available to use in solving our problem – that is, improving the economic well-being of our country. In inventorying our resources we must take into account our boundary conditions, but, at the same time, seek new and innovative ways to use our resources.

The most obvious starting point is the *natural resources* of our country – our minerals, raw materials, and energy sources. Although we are blessed with many national resources, our supplies are not sufficient in every category to meet our total needs. In addition, some of our resources, such as hydrocarbon fuels, are finite. In fact, they may be potentially too valuable to utilize for just their fuel/heat value. Our resources are available to be utilized for solutions; however, it is apparent that we should learn to use them better.

Next, let's consider the *capital plant facilities*. We established them as a boundary condition. However, if we improve them – *if* we can improve them – if we can increase production or make production less costly by improving our facilities, this will certainly aid in the solution of our problem.

A third and obvious resource is the work force. With this, of course, the goal is to increase its *productivity*. Everybody talks about productivity, but I believe it is not well understood. When we talk about increasing productivity, the traditional thinking conjures images of and is circumscribed by concepts of increasing the speed and output of machines, turning out more work in a unit of time, decreasing services, and potentially leveling or even reducing wages. Increased productivity can be achieved that way. However, our society is becoming increasingly complex and, as noted earlier, the mix of our production is changing from goods to services. It is obvious that we are going to have to develop new concepts of the man/machine interface and make the most humane use of human beings.

In the search for new ways to motivate and to develop an unusually productive work force, we must recognize the new character of our production as well as an increasing desire among workers for reduced work schedules and more variety in their work. We have not, to date, in my opinion, seriously utilized anything other than the most primitive concepts to increase our productivity. This untapped resource is a fantastic resource indeed.

We must not, however, lose sight of the fact that, if our productivity per individual does not increase, we are in serious trouble. What I am talking about is attitudes. An interesting point about productivity is that everybody believes it's for the other guy. When we talk about what *we* can do to increase productivity, we must be very certain to insert – what can *I* do to increase *my* productivity?

Coupled closely with – but distinctly different from – productivity as a resource is *human energy*. Vigor, energy and vitality. All the great civilizations – or civilizing epochs – have had a great weight of human energy behind them. When it was lost, the civilization collapsed. Our nation has been blessed with great individual and national energy. But it does not flow automatically, and the factors which release our great national energy are complex, delicate, and fragile. Certainly, our solution to today's problems must take this into account.

Perhaps the greatest resource of all – the master tool which fashions our civilization – is *ideas*. We view ideas as encompassing innovative ways of doing things, as new or better products and process, and as ways of motivating people. Ideas are really nothing more than the creative solution to a problem. As such, they are an integral part of engineering.

The Solution

And now to the solution of this problem confronting us today – the problem of defining the role of engineering in improving our economy. The solution is much simpler to state than it is to bring about. It is so obvious as to appear trite – we must apply all of our resources to the problem – in an organized plan of action. This means that proper attention must be given to our capital plants, to our profits, to our work force, to encouraging ideas, etc. We need to look at and consider all of them, in our solution.

When we look at the problem, the boundary conditions, and the possible solutions, it is obvious that engineering and technology are the keys which can unlock the resources needed for the solution. If we're going to keep our plant and equipment at the forefront, this is going to be done by engineers. No one else is able to do it. If we want to increase the productivity of the work force – and speeding up or working harder are not necessarily optimum solutions – the work force needs to have new tools, new machinery and techniques, and new processes which can make work easier, more interesting, more productive, and, hopefully, more rewarding financially. This again is something which is done by the engineer. When we look at the better utilization of our natural resources, we need to balance costs, supplies, and benefits to realize their ultimate potential. This requires the engineer.

When we talk about creating and developing new concepts for doing things better, faster, and cheaper, these again come from the engineer. All of the inventions we take as commonplace – television, computers, copy machines – were not developed out of whole cloth, they were built by innovative use of our store of knowledge to meet an existing need. This knowledge was both created and utilized by engineers.

You may recall my theme – "Engineering to the Rescue – So What's New?". After reviewing the problem from the engineering viewpoint, we have come full circle – engineers are supposed to enhance the quality of life and improve our economic health and well-being. Has this not always been true? So what's new?

Most of us know the story of Eli Whitney – how, as an unemployed boarder with a Georgia family, he evolved his epoch-making invention. We recognized that Whitney's machine was an absurdly simple contrivance which might have occurred to any whittling Yankee had he happened to be living in Georgia. Whitney's invention changed the history of America. It changed the economic, political, and industrial face of the country. Without that invention – historians have concluded – it is highly conceivable that the Civil War would never have occurred, that Lincoln would have remained a small town lawyer, and that the deeper South would have labored under the smoke clouds of factories. So 150 years ago invention – technological innovation – was very important in forming the social and economic structure of the century. So what's new?

Another venture into technical history might take us to Robert Fulton and his development of the steam boat Claremont. Fulton had to contend with skeptics and

with men blinded by hatred and fear and bent on destroying the boat. But the value of the concept was ultimately proven – a better solution conquers opposition. Today's parallel might involve the environmental extremist.

So what's new? The annals of the industrial development history of the U.S. are replete with other examples – the McCormick reaper, and in more recent times, the automobile, television, and computer. The continuous thread that runs through this history is the role of creative engineering, of innovation, of the power of new ideas, and what they can do to enhance our well-being. What is significant now, however, is that we are consciously depending upon and attempting to influence and encourage innovation.

So what's new? Perhaps all that is new – and it's not the kind of newness to which we point with pride – is the need for a new sense of national pride, optimism, and determination. We need to overcome the sense of defeat and pessimism, self-condemnation, and recrimination that is so prevalent in our country. We are much too willing to believe that all is wrong – that nothing is right about what we, as a nation, are doing. I would like to replace this attitude with what I think of as "the spirit of engineering" – that indefatigable spirit of adventure and accomplishment – a belief and conviction that a rational solution to our problems exists and a dedication to finding and applying that rational solution.

Engineers – present and future – will, of course, have a changing role in the nation's and the world's development. Engineers will increasingly be called upon for solutions to new, difficult, and important problems that relate more directly than ever before to society and its goals. In the future – and we are near the point now – it will not be possible for an engineer to pursue his profession by just being an engineer. The solution of a problem, based on optimum societal benefit, will be the increasingly significant dimension of his activities. No longer will the factory be able to simply make more units, using raw materials as though the supply were unlimited, adding needlessly to environmental pollution, and indifferently utilizing our human resource. There must be an optimization of needs, benefits, and human considerations. The engineer of the future, while drawing heavily on the past, will be and must be a unique breed. The goal and spirit of engineering – applying technology to the beneficial solution of man's problems – however, will remain unchanged.

A Case for Institutional Change

"Current institutional systems are more likely to hinder than to enhance needed efforts to confront today's emerging problems in a broader context." So says Gabor Strasser, Director of Planning for Battelle's Columbus Laboratories. In the article below, he discusses the national issue of lagging increases in productivity as an illustration of the inadequacy of U.S. institutional systems.

Much of the material in the article was included in Strasser's testimony in April before the Joint Economic Committee of the U.S. Congress, where he was invited by Senators Proxmire and Percy to speak on issues of productivity. He sees productivity as an all-important factor in national well-being, and certainly as one of the vital elements of the deteriorating U.S. international economic position described by Fawcett in the preceding article.

THE NEED FOR INSTITUTIONAL REFORMS AS ILLUSTRATED BY CURRENT PROBLEMS IN U.S. PRODUCTIVITY

by Gabor Strasser

Can Existing Institutions Cope with Present and Future Problems?

This current concern with productivity in the U.S. comes on the heels of many other problems. These include environmental pollution, urban blight, poverty, inflation, unemployment, or the things that prompted the emergence of the technology assessment concept. Undoubtedly, still other problems are incubating for the future. Of course, there is nothing new about this seemingly endless stream of problems confronting us. What may be new, however, is that the *manner in which we have been coping with our problems in the past may no longer be appropriate for the future, due to the following two reasons.*

(1) In this world of ever-increasing complexity, the interrelationships among our various problems, as well as their solutions, have become ever more significant and critical. In spite of all this, our practice has been, and continues to be, to deal primarily with one problem at a time. Intuitively we know this to be wrong. But we do it anyway, since a better integrated approach is much more difficult, and since there are strong pressures on us to solve problems that are singular, current, and pressing. Not infrequently, solutions of this type in one area cause more damage in another; or, the practice may create more problems in the future than it solves today.

(2) The other reason why we are having difficulties in coping with our problems today, is that institutional systems within which we solve our problems are tailored not to integrated, but to singular problem-solving. The built-in incentives, our "rewards" and "punishments" are all geared in this direction. Current institutional systems are more likely to hinder than enhance needed efforts to confront today's emerging problems in a broader context.

> *Therefore, even if we could develop a better integrated approach to our many problems in an intellectual, substantive sense, we could still not succeed, unless we also allowed our institutional system to evolve correspondingly.*

This article examines this assertion more fully, using productivity as an illustration. It will be demonstrated that not only is it difficult, for example, to address productivity within the context of our other problems, but even an attack on the productivity problem alone is hindered by our insufficient understanding of the relationship among many of its own elements.

The Dependence of National Well-Being on Economic Progress and Productivity

Much has been said and written about the relationships of: productivity and inflation, international trade, the consumer, labor,

industry, economic theory, and science and technology. I want to broach the subject in a manner that is both more simplistic, as well as broader in scope. More simplistic, because I will pursue neither in great depth nor with great precision the kind of singular relationships to productivity just enumerated. Broader in scope, because, instead, I will try to speculate on the *interrelationships among the many productivity issues*, as well as their relationships *to other issues*.

In this spirit, let me start by asking: *Why is productivity so important as a national issue?*

Historically we have tended to equate economic progress with national well-being. The validity of this concept is now coming under ever-increasing scrutiny. The focus of our attention is shifting from mostly material considerations (as measured by the average per capita GNP and its various derivatives), to a host of social, environmental and aesthetic values. This may, in turn, warrant changing the focus of our attention from the Standard of Living Index as currently conceived, to a more general one, encompassing a broader spectrum of our Quality of Life. Improved educational and other opportunities, better health care, the reduction of urban blight, the amelioration of environmental pollution, personal safety, and many other similar considerations have taken on increasing importance under this concept. Looking at it another way, this shift may represent society's reexamination of its value structure, as a prelude to the reordering of its priorities. Indeed, this process is already under way. There are debates about societal versus personal well-being, aesthetic versus material values, and the distributional aspects of personal disposable income.

However, irrespective of the nature of these objectives, achieving them will still cost money, and therefore will depend on the fruits of our economic progress.

> *Hence, the rate at which we as a nation will be able to improve our Quality of Life in the future, will be inexorably tied to the rate of increase of our efficiency or productivity in producing goods and services. This extremely important fact is all too often overlooked by many of our Quality-of-Life proponents.*

While today we may no longer simply equate economic progress to national well-being, there is ample evidence to view as axiomatic the extensive dependence of national well-being upon economic progress and productivity. This, I believe, will remain true, irrespective of what turn society's reexamination of its value structure might take, what the line-up of new priorities will turn out to be, and how materialistic values will fare versus aesthetic ones in the final analysis.

What is Productivity?

The fundamental concept of productivity is simplicity itself: Output over input. Or roughly, what got produced divided by what it took to produce it. However, this simple concept begins to get complicated when we examine what, in fact, are included in the quotient.

Input may be considered as labor alone; or, labor and capital; or, management may be added as a separate item. Then, perhaps as part of the input, some of the social costs of the process may be included. One obvious manifestation of a social cost is environmental pollution, the cost of which is is borne by the public by virtue of being exposed to it. This type of cost is often referred to as an external cost.

On the other hand, what is most commonly included in the output are the items and services that are produced, or the value of what is produced. Perhaps, when appropriate, external benefits should also be included when these accrue to, rather than are "paid for" by society. An example may be the building of a commercially viable plant in a depressed area, resulting in a decrease in welfare rolls and unemployment compensation, thereby benefitting society through the reduction of a social cost.

We should take longer views of our problems, in the context that increased productivity is not an end but a means to

"buy" a better quality of life. Then, perhaps, questions like the following may not be unreasonable. What are the social costs and benefits, associated with a productivity increase that impinge on our working conditions, or on the environment in which we live? Obviously, neither of the following two extremes is acceptable: One, maximum output with no concern for the individual or the environment. Two, maximum job satisfaction and total environmental protection, with no concern for our output. Therefore, what is obviously needed is some acceptable balance through appropriate trade-offs.

It is clear that a host of trade-offs are feasible. And, depending on what we include and how, there could be a wide variation in what we measure as productivity. This is further complicated by the fact that neither the elements of the input, nor the elements of the output, are readily commensurable. Dollars are easy to incorporate on either side. So is capital investment on the input side, as long as we know the cost of borrowing money. It gets a bit more complicated when we talk about R&D, management, or labor, since even though the price of such services can usually be ascertained, their true cost may not. When we talk about social benefits, or costs, considerable subjectivity enters into the determination.

Whose Productivity?

Hence, there are a variety of ways productivity can be viewed.

Understandably, when labor looks at productivity, it is primarily concerned with what is termed labor productivity, where the input consists of labor alone. Desire by management to improve productivity is often viewed by labor as "speed-up", which some equate to exploitation of labor. From labor's point of view the objective is to maximize the return to labor, for services performed by labor.

When management looks at productivity, it tries to orchestrate labor, capital, and whatever additional resources may be appropriate to maximize profits. If, in the process, some costs can be externalized (e.g., through environmental pollution), then, from the point of view of corporate profitability, this may be a desirable course of action. In this case the objective is to marshal appropriate resources, and externalize costs to the extent permissible so as to maximize return on investment. Incidentally, the attainment of this objective is hindered by the fact that we do not have a sufficiently good understanding of what to manipulate and how, in order to increase productivity.

When the Federal Government looks at productivity, we must first ask who in the Federal Government we are talking about.

We know that improved productivity, per se, would indeed help combat inflation. Therefore a posture advocating productivity improvements by the Price Commission is a most reasonable one.

We also know that the Departments of Commerce and Treasury would support a similar course of action, because this would improve our competitive position on the international marketplace and help with our balance of payments, respectively.

On the other hand, if such productivity increases can only be realized through "unacceptable" environmental pollution, then the Environmental Protection Agency or the Council of Environmental Quality will object, based on another respectable but conflicting national purpose.

Also, if such productivity increases are dependent on courses of action which conflict with existing antitrust or patent laws, then the Justice Department will take issue for some, yet another respectable but different consideration.

It is, of course, not improper for the Departments and Agencies to have different views on the same subject. Nor is it desirable to change this. It is most desirable, however, to bring about some system, where such different views on the same subject could be somehow reconciled more expeditiously, in a more orderly fashion, in the interest of the nation.

What we are confronted with here is a manifestation of the problem of balancing often conflicting national purposes. As mentioned before, the generic nature of this problem is not new. What is new is that in our world of ever-increasing options and complexity, making essential trade-offs is becoming ever more necessary and difficult. This problem, of course, is not limited to considerations of productivity enhancement.

> *We seem to lack the ability to view our many problems and opportunities at a sufficiently high level of aggregation so that appropriate trade-offs could be made from the point of view of national interest. We need broader frameworks than what we have today, for laying out options and costs for the public to scrutinize, and for Congress and the Executive Branch to study and act upon.*

Is U.S. Productivity in Trouble?

Many consider the current productivity problem a normal cyclic phenomenon. Fortune Magazine in February discussed the subject in a similar vein, and the April 24 issue of Newsweek implied that things are improving. Patrick E. Haggerty, Chairman of Texas Instruments, Inc., in his many public statements attributes our productivity problems primarily to the following. The U.S. "service sector" with low productivity increases accounts for over 50% of the U.S. labor force, and this percentage is increasing. Peter G. Peterson, Secretary of Commerce on a recent television interview claimed that the greatest blockage to the solution of our productivity problem is lack of public recognition of the magnitude of the problem. Some of the evidence supporting both Messrs. Haggerty and Peterson are included in Sherwood Fawcett's article in this issue.

The reasons for such variations in opinion are many-fold. First, conceivably things were never quite as bad as we feared 6 or 12 months ago. Second, whether we compare our productivity as such, or its first or second derivatives, with those of other countries, the results can be startlingly different.

What, however, do remain facts, after all is measured and said, are the following:

(1) For the first time in our history our service sector, with chronically low productivity increases, makes up over half of our labor force, thereby markedly decreasing our national average.

(2) We have been experiencing an "unacceptable" combination of unemployment and inflation (The Phillips Curve has shifted).

(3) We must compete on the international marketplace with nations of rapidly increasing economic and industrial power. Furthermore, these nations have at least for the present lower standard-of-living aspirations than we do.

(4) We have become used to an ever more rapidly increasing standard of living (positive second derivative) which inexorably depends on our real productivity increases, which, of late, have been sagging.

Hence while based on certain historic measures of productivity, we may not be as badly off as we originally feared, things have changed sufficiently to warrant our continuing concern about productivity. These changes manifest themselves on both the international scene (emerging new economic powers, international trade), as well as the domestic scene (changing values, rising expectations).

The Study of Productivity

Even though studies, books, and articles have proliferated on productivity, we still lack adequate understanding and appropriate mechanisms to manipulate it to our advantage.

What are some of the more specific rather than general reasons for this?

(1) While we have reasonable data on average *quantitative* productivities in certain groups of our labor force and in some of our industries, we have difficulty incorporating *qualitative* considerations into such measurements.

(2) Even in our overall quantitative

assessments, we don't seem to be able to ascertain the *partial contributions of the elements* of productivity (such as R&D, labor, management, etc.) to overall, gross productivities.

(3) We have not come to grips with the problem of how to determine when *not* to strive for productivity increases. For example, there may be certain industries where irrespective of what we might do within reason, they could still not become competitive. Or, there may be situations where an increase in productivity in an unskilled or low-skilled, and already saturated market, may place the labor force on welfare. I am neither advocating anyone sitting in judgment over the life or death of any of our industries, nor indefinitely subsidizing unskilled or low-skilled labor. I am, however, advocating a better understanding of the issues surrounding such problems, which so far is lacking.

(4) Great strides have been made in economic theory as well as in practice. Equations in econometrics, for example, are often as sophisticated as the ones in nuclear physics. However, the fact remains that in econometrics many of the inputs or variables (upon which our answers depend) are more subjective than objective. They are often people-related, reflecting human moods, concerns, hopes, and fears. This is in sharp contrast with the coefficients and variables in the equations of the physical sciences, which deal with inanimate, reproducible things. Reasons such as these are responsible for some of our difficulties in adequately understanding and then enhancing productivity.

(5) The study of productivity takes place within the discipline of economics. In an era of changing human aspirations and concerns some of our economic equations or models (at times using inputs based on yesterday's concerns and values), occasionally fool us. An example of this assertion is the recent shift of our Phillips Curve, relating Inflation to Unemployment. Understandably, this relationship is influenced by many subjective, people-related considerations. Since what seems to be important to society is changing, perhaps the shift in the Phillips Curve is one reflection of this change.

Now what are some of the approaches to a better understanding of productivity?

(1) There are many generic, economic studies. However, these are usually too abstract, and are in fact usable only in a theoretical sense. They are difficult to apply to complex, real situations.

(2) There are also numerous pragmatic case histories that are relevant, practical, and real. However, these suffer from lack of transferability of their results to other situations.

(3) *Some combination approach is believed to hold promise. Namely, the simultaneous undertaking of two kinds of studies. A search for the generic nature of the relationship between the appropriate causes and their productivity-related effects, in combination with a study of a number of relevant case histories. If done in a parallel iterative fashion, the former approach should lend transferability to the results, while the latter should give it practicality and relevance.*

With an approach like this, we may be able to shed some light on some of the missing links in our understanding of productivity, as well as test out some of the often talked-about notions, such as the following.

(1) *Impact of various changes in anti-trust and patent laws on various productivities.*

For all practical purposes our antitrust legislation started with the Sherman Act of 1890, to make it illegal to "monopolize trade". Much has happened since then. Many industrialists feel that some of the laws on the books today no longer serve the purpose for which they were enacted, while at the same time they handicap U.S. industry on the international market. Also, some small businesses cannot take collective advantage of some R&D or other resources

which practice, ironically, may be not against but in the public interest. We should examine the validity of such assertions, and consider modifications where, on balance, such are desirable.

Insofar as our patent laws are concerned, allegedly some similar arguments hold. One example is the numerous U.S. patents which could be licensed only on a non-exclusive basis. There is great reluctance to undertake on a non-exclusive basis the turning of such patents into marketable and hopefully profitable products. The process is risky and expensive, and unless the entrepreneur has some protection against others moving in on him, he will be reluctant to proceed.

In short, some adjustments in our present laws might enhance our productivity, as well as our competitive position on the international market. If such adjustments would not violate the original intent of the law, or change something that we are no longer concerned about, then why not consider such adjustments?

(2) *The impact of depreciation allowances of scientific/technical equipment, based on scientific/technical, rather than physical obsolescence.*

Allowing more rapid depreciation on equipment in good physical condition but which is technologically "obsolete" may serve as an "incentive" to industry to "modernize" its plants and become more productive.

(3) *The interrelationships between (a) the way in which benefits of a productivity increase may be apportioned, and (b) the manner in which the increase is brought about in the first place.*

The fruits of a productivity increase may be used in a variety of ways. For example, boost wages – increase profits – reduce the price of the product or service – increase dividends – pay more taxes – make social and environmental improvements – improve working conditions, etc. While we don't exactly understand the mechanism of a productivity increase, we do know that the just-listed benefits resulting from increased productivity accrue to many of those upon whom the increase depends in the first place. Some prior understanding of the distribution of these benefits may serve to stimulate the process.

(4) *A better understanding of foreign experiences.*

An analysis and comparison of foreign experiences, in terms of initiatives, attitudes, and blockages to productivity increases, may prove to be most instructive, even though much of this may not be directly transferable to our situation. Japan, of course, is an interesting case in point. For example, what enhanced their phenomenal post-war economic growth could be attributed to such causes as: (a) plain hard work, dedication, and ingenuity, (b) collective personal commitment to national goals (a cooperative rather than an adversary approach by labor, management and government toward attaining goals), (c) privileged treatment given to them on the international market.

What may argue against their uninterrupted economic growth are items, such as the following: (a) undercapitalization of their industries when compared with the USA, (b) extensive dependence of their domestic well-being on even slight perturbation in their exports, (c) extensive externalization of much of the cost of their production into the environment causing pollution problems in Japan and especially in greater Tokyo, (d) "westernization" of the Japanese, resulting in ever-rising personal expectations, (e) geographic confinement, placing a ceiling on expansion and growth.

Examination of the French and other European situations may also be highly revealing, with their practices steeped in tradition. At a recent conference in Paris, I suggested increasing the productivity of their subway, the Metro, by considering turning to the token/turnstile operation, in lieu of their

present system. In the Metro one employee sells tickets, another one punches them, and a third sweeps them up, since most everyone throws away his punched ticket. They asked me what would they do with the people who, as a result, became unemployed. I suggested that surely they could become engaged in more constructive work, especially since the accrued savings from such modernization could help subsidize the training of dislocated people. The discussion ended abruptly, when I was told that I just don't understand the French mentality, which I readily admitted was correct.

Our post-Korean war experience with the Koreans, in assisting them to rebuild South Korea shed some interesting light on what motivates those people, which is very different from our value system. This difference could perhaps account for the fact that our massive aid to that country, based on the incentives of western cultures, was not as effective as it might have been had it been tailored to their value system.

When I recently lamented to an English friend about the predicament we are facing as a result of the decreasing increases in our productivity, *vis-à-vis* some of the rest of the world, he told me that I am overlooking one of the most significant elements of the solution to the problem. Namely, that as time goes on other countries will experience problems similar to ours, and the gap I am worrying about will be reduced as much by the increasing problems abroad, as by the fixes we will be able to bring about in the U.S.

While I have not thought through the nature of a study of foreign experiences in increasing productivity, I do believe it is a subject worth a closer look.

Hence a structured approach to productivity enhancements may include the examination of the following elements.

(1) Government incentives through appropriate changes in antitrust, tax, and patent laws, as well as depreciation allowances.

(2) The a priori allocation of the expected benefits of increased productivity among those who bring about such increases in the first place.

(3) Foreign experiences.

(4) The removal of institutional and especially procedural blockages that stand in the way of productivity increases.

Obviously, all of this should be done with full cognizance of the impact of such actions on other national purposes and objectives. This brings us back to the problem of sorting out, balancing, and then choosing from among competing national objectives. Let us now return to this problem, which is broader than productivity, and see if some useful conclusions may be drawn.

The Imperative of Making Orderly Trade-Offs and Choices

One of the easiest ways to focus on the problem of choices that are confronting us, is through an illustration drawn from the area of environmental pollution, where personal/materialistic benefits are pitted against societal/aesthetic ones.

In the last issue of *SPR* (Vol. 5, No. 1, 1972) I cited examples of manufacturers discharging toxic effluents into the streams, individually driven automobiles polluting the air, and municipalities discharging raw or insufficiently treated sewage into the rivers. There are repeated demands to end these spillover costs and abuses. But this is easier said than done. Such spillover costs can merely be rerouted into the original cost of the product. And, even before the cost can be passed on, if at all, from producer to consumer, other problems emerge. For example, if a paper pulp manufacturer who has been polluting a river is to be prevented from doing so in the future, he must install devices to control or eliminate the discharge of his pollutants. This adds to the cost of his production, and in fact reduces his productivity. Since many such companies have been only marginally profitable, it would not be

surprising if a massive effort to force certain industries to internalize their external costs would bankrupt them. Many similar examples could be cited. *In total, they convey the message that many of our industrial products are profitable only because some of the costs have never been absorbed by the producer and ultimately by the consumer.*

While this is not "right", it is nevertheless a fact, and therefore must be considered as one of the relevant and hence necessary points of departure in our search for solutions.

Hence, the broad economics of the environmental problem raises two questions:

(1) *How to reverse, as we must, this trend of spillover costs into the environment?*

(2) *How to devise expeditious and fair transitions, without causing unacceptable disruptions in our economic, social, and political system?*

In a way, these questions raise the dilemma of environmental/aesthetic versus economic/material values.

It is interesting to note the evolution of this dilemma. First, the conservationist, concerned with the preservation of our natural resources, sent up the danger signals. Next, the ecologist (biological ecologist, that is), concerned with the relationship between living organisms and their environment, showed us how our comfort, health and even survival may be endangered. Now, in our search for solutions we realize that the base of biological ecology is not sufficient. We must be sensitive to sociological ecology as well, addressing the relationship between the distribution of human groups with reference to material resources and the consequent social and cultural patterns.

In addition to being concerned about their physical environment, most people can be expected to continue to be very much concerned with material goods, personal wealth and comfort, as well as the status that these possessions bring to them.

Hence, the upgrading of our physical environment will compete for the very same funds that people use for personal possessions.

The notion of: "Let the Government clean up the environment" does not work, since the Government must pass on the cost through taxes and thus reduce disposable personal income.

The notion of: "Let industry pay for it, they do the polluting" does not work either, since the cost ultimately shows up in the price of consumer goods and services.

The man of the 70's will be faced with nagging questions such as the following:

- I don't want to give up my car, but at the same time I don't want to pollute the air. How much should I pay for emission control devices?
- How much sewerage tax assessment should I vote for (and forego the purchase of a color TV set or a vacation) to improve the quality of the river in my back yard?
- Should I turn off the air conditioner so as to reduce the galloping demand on our energy resources, as well as alleviate some of the concomitant pollutions?
- Or, more generally, how should I trade off environmental/aesthetic benefits for personal/economic ones as an individual? Or, with my vote as a member of society?

The Disparity Between Wishes and Reality

Necessary choices, as represented by these questions, will pose difficult problems, especially since our notion of what is desirable or tolerable has been upgraded. We expect more today. This condition raises a very crucial question.

Are the aggregate perceived needs or aspirations of the USA greater than its marshallable aggregate resources? But, more important, are the perceived needs increasing more rapidly than the resources? If so, the disparity between

what we want and what we can have will likewise keep increasing.

Individuals are more concerned with such *disparity* than with *needs* or *resources* when viewed *separately*. It is fitting, therefore, that societal planning should also focus on such disparity.

What influences this disparity?

Population increase, together with our ever-rising expectations, combines into a rapidly expanding aggregate perceived need, while more ingenious and more efficient use of our natural, physical, and intellectual wealth increases the available aggregate resource.

The fundamental questions which need to be answered, therefore, are the following:

(1) Have we a disparity in this Country today; that is, are our perceived needs greater than what we can have?

(2) If not today, is such a disparity about to emerge?

(3) If so, is this disparity expected to get bigger in the years to come?

(4) How big can such disparity become before interfering with peaceful democratic processes in the resolution of societal differences?

Trade-offs and choices will become more and more difficult, since not only our aspirations but also our options are getting more numerous, while our wealth, however enviable, is still finite. Appropriate mechanisms to make such necessary trade-offs and choices are simply non-existent today.

It is clear that desirable, defensible programs could be postulated in a host of areas that could absorb not only the entire Federal budget, but the GNP many times over. Hence, the need for some overall integrated approach to our affairs seems to be well overdue. The current, fragmented one only works acceptably when available resources substantially exceed the demands that we place upon them. As our resources and demands for such resources come into balance, or turn negative, the necessity for efficiency, overall understanding, and better management becomes obvious. This is the problem we are facing today. When crises occur intermittently with long periods of lulls in between, it is not imperative that we look at our problems in their totallty. But, when problems, some of which approach crises, begin to overlap (e.g., intermittent sporadic wars throughout the globe, international monetary crises, inflation and unemployment at home, social unrest, urban blight, environmental pollution, and many others), it behooves us to sort out these problems and their interrelationships and ask ourselves questions like the following: How can we better use what we have for those things that we consider most important? How do we keep support for important programs from falling below some acceptable threshold levels? How can the political system get credit from the public for embarking on essential courses of action that are tedious and time-consuming, with the payoff well in the future, rather than having to prove itself continuously and primarily on the basis of what it can fix today? Most of our current pressing problems will not respond to quick-fix treatments. Hence we do need some new mechanisms to help make our deliberations, decisions and actions more reasoned and hence more rational.

Mechanisms for Decision Making

Now, how do we bring about such mechanisms? This is yet another story. Much of the existing system views such mechanisms as threats to entrenched vested interests. I hope I am not too naive to overlook this most important consideration. However, I have approached this issue primarily from the point of view of "desirability" rather than "feasibility", since I believe that "desirability" will soon turn to "necessity", and therefore, we will have no choice but to overcome, one way or another, this "feasibility" impediment.

But, where should such mechanisms be institutionalized? I believe they are needed within the Executive, as well as within the Legislative Branch of Government. The

former needs it to better plan, design, and implement Federal programs in their totality, as well as assist, not dictate, other national efforts within some common context; the latter needs it to bring about more rational public debates, to view the many options against one another, and to be in a better position to rationalize not only what is in the budget and why, but also what is not, and why not. Within Congress some Division or Office of Goals and Priority Analysis, as has been considered in the past, may be the kind of function that is needed. Within the Executive Branch, the mere strengthening of the Management function of the Office of Management and Budget may be a step in the same direction.

If we had such capabilities today, we would be in a better position, for example, to (1) assess the real importance of improving our productivity, (2) determine the areas in which productivity should be stimulated, (3) find the best way to simulate it, (4) determine acceptable interactions with other objectives, and (5) identify reasonable expectations from, and roles by, labor, management, and the Government.

Institutional Reforms Needed

What is perhaps even more telling than this, is that we could have substituted in this article any one of a host of different problems other than productivity, and still demonstrate how existing institutional systems often block rather than enhance solutions. These different problems could have included health care delivery, education, the better "exploitation" of science and technology for the benefit of mankind, or many others.

Harold J. Leavitt in *Managerial Psychology** says that problems get solved through a dynamic, interactive, three-part approach. These are (1) Structural Solutions, (2) Technical Solutions and (3) People Solutions. A "proper" balance among them is essential for success. What I said at the outset about "institutional systems" would come under Leavitt's Structural Solutions; what I referred to as "better integrated approaches at higher levels of aggregations" are the kinds of things Leavitt means when he talks about Technical Solutions; and my discussion about "vested personal or institutional interests representing blockages to solutions" would perhaps fall under Leavitt's People Solutions.

On the other hand, Systems Approach taught us that when a solution depends on a number of elements, usually the greatest progress is possible when we make better use of the least efficiently used element. This is especially true when other necessary elements have already been exploited, and their marginal utilities have become small.

The combination of these two notions, together with the difficulties with our institutional systems, as alluded to in this article, infer that institutional renaissance may be the primary key to the solution of many of our problems today.

A search for overlaps between desirable and feasible institutional reforms will be the subject of an article in a later issue of SPR.

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*University of Chicago Press, 1967.

To Ensure the Health of Science

H. Guyford Stever became the fourth Director of the National Science Foundation on February 1, 1972, succeeding William D. McElroy. Dr. Stever, a physicist by training and an aeronautical and aerospace engineer during much of his long academic career at MIT, took over the helm of NSF after seven years as President of Carnegie-Mellon University.

His views on NSF's and science's role in the next few years are eloquently expressed in an article in the Spring issue of the NSF journal, **Mosaic** *(see Publications Screened at the back of this issue). Stever's article is reprinted here by permission.*

WE'RE THE AGENCY TO GUARD THE BASIC RESEARCH END OF THE SPECTRUM

by H. Guyford Stever

We should never lose sight of the basic mission of NSF: to ensure the health of science in this country. From that base, we can go a long way. We're the only agency charged with that mission, and by tradition, we're *the* agency to guard the basic research end of the spectrum. Research is the mechanism of science; it's the action component of science. It's how science moves forward. It's how science responds to society. It's how science answers curiosity. We're the guardians of that concept, as far as Government agencies are concerned. The science community, with its tremendous capabilities for good, must remain an integral part of our society, related to it, communicating with it, understood by it, and supported by it.

Society, in turn, expects to tap the ideas of science and apply them to its general activities. So, in our communication with society and in our service to society, we have to be sensitive to the applications of science. By that I don't mean that we're going into the hardware business, but anything we can do to generate good ideas and aid their flow into society and to give society an understanding of this whole process is very important to us. This is the real mission of RANN [NSF's Research Applied to National Needs]. It's the first link in the long chain from basic science to a product or a service.

Some Sciences Undergird All the Rest

How to determine which sciences should be pushed is very difficult. Experts in science generally work in some specific field. They may have understanding of broader areas, but they can't have enough knowledge generally to weigh all of the factors of science. No one person can. Obviously, there are some sciences that undergird all the rest of the structure of science – mathematics, physics, chemistry, biology. One can't have a structure for science that ignores their central role.

Then there are some sciences I would call derivative sciences – like geology or environmental science. These sciences use basic laws, but they develop them into more complex forms. For example, the laws of fluid flow used in environmental activity go back to basic physical laws, but they themselves are derivative laws.

As the world progresses and as science progresses, there are more and more of these derivative sciences, and they take on character and body themselves. That pattern is reflected here in the Foundation, where we continue to add new programs to our basic science complement.

I think you have to weigh a field's importance by looking at the opportunities within it. Are the scientists there on the threshold of great things? And how do these great achievements compare with our capability of supporting them, too? For example, I'm told by astronomer friends that their field is more exciting than ever – new objects in deep space, black holes, the new concept with respect to the red shift. There are great discoveries today that seem to be opening up endless opportunities. Personally, I would encourage any plan

that said, "Let's find out." On the other hand, astronomy is leading us to very large and expensive instruments; and at this time in history, when economic resources are strained, another big machine poses a problem. The same situation exists with respect to physics accelerators.

So, I look for a practicality in science. There's the opportunity, there's the practicality, there's the business of how a science relates to other sciences. If one sees an opportunity for a science to help several other sciences, especially the derivative sciences, one goes in that direction. There is also the factor of proposal pressure – the requests for support that come into NSF. Clearly, if circumstances develop in which the support of an important science drops off at another agency, we have to make sure that such a basic science is strongly undergirded. That doesn't mean we take everything that's dropped, but it is our mission to ensure the health of all science. This balancing is critical, but there are fewer rules to go on in that area than there are for weighing basic versus applied sciences. It's just a tougher job.

Science Doesn't Advance on a Uniform Front

Of course, pressures of the society-at-large are clearly a factor in some of the derivative sciences, such as the environmental sciences and oceanography. Timeliness is obviously an important factor. Science doesn't advance on a nicely uniform front. There are a lot of pods and pseudopods going forward. Physics, for example, got tremendous support in my lifetime because physicists were very successful in turning to in World War II, in radar and underwater sound particularly, in weaponry generally, and in atomic energy. The war was an external circumstance that caused basic science – especially physics – to move forward very rapidly.

Today, other external pressures affect the life sciences: the demand for better health care, concern for the cure for diseases that have been around a long time, the need to feed an increasing world population. And the emerging problems of the cities and of handling big issues are giving a tremendous boost to the systems sciences. Of course, we can't be carried away completely by these external forces. We can give and respond to them, but not unilaterally and completely. To do so would unbalance the total structure of science.

We're Not Being Forced to Defend Basic Science

Many people are discouraged about scientific and intellectual effort in general today. They feel that society has turned away. My feeling is that in the malaise of the last few years most components of society turned away from the others. It wasn't just science and intellectual activity that were under pressure – all activities were. But I see signs now that these divisive movements of the recent past are healing and rejoining. Society is again moving more coherently.

I hope we learned from that period of upheaval that science should be responsive to the needs of society. Some people interpret these needs purely in economic terms, some interpret them in terms of much larger needs of society as society shifts its value systems. I believe that most people who are settling down to address some of the big issues of society on a long-term basis recognize the important place of science.

I can't think of any more convincing evidence of that than the President's message to Congress on the importance of science and technology. To me, that action, which is really unprecedented, reflects the substantial public awareness of how closely all of our futures are tied to what happens in science and technology.

But really, we're not being forced to defend basic science and its importance. Basic science isn't going to suffer, though there probably will be more emphasis on the part of society in applying science. People worry a great deal about these relative emphases, whether one robs the other. In the long run, I don't think either robs the other. But we won't have a healthy science system unless we come to some reasonable

balance. That doesn't mean that we're converting all the basic scientific researchers to applied science. In fact, we can handle the new demand without upsetting the basic sciences because scientists are, as we know, not in short supply at the moment.

We Have a Broad Scale of Competency in Our Constituency

The number of national needs that RANN has selected to work on is small and is based on the kind of thing that the scientific community can do. The scientific community has certain characteristics and capabilities, so that's one of the constraints on the RANN program. Another constraint is that we shouldn't be involved in those areas of national needs where other units of Government or society are supporting science very strongly.

Let me mention some areas where we are working. I think that society badly needs a very sophisticated examination of energy and resources, because so many of the energy issues have both short-term and long-term scientific implications. NSF can make an important contribution there.

There are some derivative sciences that NSF has been involved with – the systems sciences, the whole business of large-scale human systems analysis – which may take off and be of tremendous value to society in the next decades and centuries.

It's clear that there are serious problems in materials, because so many artificial materials have undesirable properties. They're not degradable to original components, and they have adverse effects. There's a problem of productivity and competitiveness in an economic sense, and this is intertwined with technical processes. That's another area where I think we can help.

Don't forget that the NSF's research clientele already includes people in the basic sciences, in the derivative sciences, and in the applied areas. We have a broad scale of competency in our constituency, and I think we can contribute to many of these national needs. RANN's big problem is knowing when to stop, when to get work transferred to another agency for implementation. But this has been an age-long process in science. When does science leave off and development take over?

Our new Experimental R&D Incentives Program – undertaken at the request of the Administration – deals with science at the stage where perhaps it can be used for practical innovation. For my book, the word *experimental* is important. We really are conducting experiments to see if we can develop some more effective institutional relationships in society. We hope to find out if ideas coming from research can be made to flow into society faster, and also try to discover if there are some removable roadblocks in that flow. But, as I say, it is an experiment.

NSF is Very Serious in Its Science Education Program

NSF's course with respect to science education is changing, and I want to explain our rationale. With respect to education in science, you have to look to the universities, colleges, and high schools. NSF has a relationship with those institutions in many forms, but our most substantial involvement is in the support of scientific research. By supporting science in the universities and scientific research at the graduate level, we also contribute to their educational programs, which are intertwined.

Now, a second place where we impact on them is through science education support, the content of the courses as opposed to the content of the research programs. We've had great success in the past in developing new curricula, new teaching methods, and in upgrading the education of people all up and down the chain. In this area of impact, there is now a strong feeling developing that we should look to the future rather than to the past and reorient some of these programs to adjust to society as it is today.

Scientific education has a broader mission than just educating scientists. There are different kinds of students and different kinds of jobs to prepare for, and they also deserve attention from science educators. There are new techniques of education, new equipment in education. Our job is

to keep on that forefront and try to develop the new. That's the reorientation of the education program – and success in it will increase scientific research potential.

There is a component of education of students and teachers in summer institutes, and there is a component of participation in research by undergraduates. We're not trying to knock that out, but we're trying to change the form. NSF is very serious in its science education program. We think it's important.

There's another way that NSF impacts on academic institutions, of course, and that's in the form of institutional support. It's no secret that our institutional support program began to diminish some years ago, and that trend is continuing. The general feeling is that NSF should support institutions through research programs and development of scientific curricula rather than through heavy direct institutional support, such as our excellence grants. My personal feeling is that we shouldn't carry this to the extreme that we have no institutional support in undergraduate schools. But again, that may change in form. The health of the institutions is important to NSF, but NSF is not nearly strong enough in its total available funds to carry these institutions on its back.

Next Year We Expect to Support a Small Increase in Graduate Students

As for the support of graduate students, NSF is not backing away. The competitive graduate fellowships are still there, but other support of graduate students is being shifted more to research projects. Through this mechanism we can continue to adjust to the needs. I personally think that the dropoff in graduate student support of recent years has bottomed out, and next year we expect to support a small increase in graduate students in science.

I don't think anyone really knows the answer to long-term manpower supply in science. I know perfectly sensible people making equally cogent arguments on both sides of the issue. Naturally, the importance of science to our society demands continued education and production of scientists and engineers. The crisis of temporary unemployment is real, though we may have overestimated it. It's clearly a local phenomenon with respect to both geography, certain parts of the country, and certain fields. But I'm still not sure how one can predict future manpower needs. Because of the uncertainty, I think it's a mistake to bias the system heavily in either direction – increasing our output drastically or cutting it down. I'm a little concerned that with some of the measures and with some of the last few years' disenchantment with science, maybe we've overcorrected the system downward. It's important for NSF in the very near future to begin to put these things together as well as it can, so we can adopt a sensible and sane policy on it.

Many Feel We Don't Use Science as Well as Others

As far as the health of this country's pure science is concerned, we're pretty powerful. We want to stay powerful. But if we look at the official amassing of scientific strength done by governments, many people feel that we don't use science in our everyday civilian, nonmilitary business as well as others. They say that other countries are turning to more effective programs for doing this. This is a national and international movement and probably will be characteristic of this time in history.

Obviously, different segments of our society have a different receptivity for the results of research and development. One of our objectives is to improve the receptivity in those areas where receptivity isn't great. But there is still a lot of misunderstanding. For example, the textile industry is often cited as a typical "low-technology" industry. But there are some aspects of textiles that are not low technology at all. Now, we have improved weaving and new fibers. We have to be much more subtle and sophisticated in our analysis of how and how much science enters technology and technology enters society.

Our society is changing from production-

oriented to more of a service society; industry will have to turn increasingly to organizing services as well as producing goods. The role of industry also has been changing in the past five years with respect to its social responsibilities. In both of these moves, new kinds of research and development are required. I see no reason why we can't develop some incentives to encourage people to work on these problems. I'm mystified that, at this moment, it's a lot easier to buy at a reasonable cost a product of industry rather than a service of industry. Why don't we get these things in adjustment?

The Emphasis of Government R&D Has Shifted

In our complex society, all of the different groups are so busy and so carried away with their own business that they find it hard to understand one another. It isn't only science and technology that have a difficult time being understood, but other activities too. Of course, science has a particularly hard time because it is deep and complex and has very deep implications for society. But if you stand back to get a little perspective, you realize that the sophistication of our nonscientific Government leaders has increased immensely with respect to science. The understanding of science by those in authority and responsibility is a lot better than ever before. I would add that the emphasis of Government research and development has shifted substantially in the past 15 years, with a far greater involvement in civilian, rather than military, priorities.

In general, I think science fits into our society more easily today than it ever did. Sometimes we have too great expectations, and sometimes we have misunderstandings with respect to the implications of a field of science, but I don't think it's really bad if we continue to work at it. We communicate better than we give ourselves credit for -- though still not well enough. Within the intellectual world itself, I think we have a harder time understanding across the boundaries between fields than does society in general. Society as a whole, I think, takes science with a little more ease.

One thing we can learn from the activism of the past five years is that scientists, engineers, and everybody involved in technology have a communication problem with respect to society. But now I think society in general has somewhat greater confidence and willingness to undertake the job of reaching some important goals. One of the things we learned from the activists is that we'd better get on with the job of more carefully watching our natural resources and the environment relative to our productivity and our economic strength. We see now that there is no black and white in any decision we make, and that the interrelationships of things are becoming much more apparent.

Technology Assessment Has a Long Way to Go

Technology assessment obviously is moving along; there's legislation pending on the Congress. So the work to which some scientists contributed is showing fruition in Government. Personally, I think technology assessment has a long way to go. We have to learn techniques and approaches, and they're going to be tricky. We have some assessment programs in RANN, and we're experimenting with methods and trying out assessment in a few fields. I don't foresee NSF becoming the technology assessment agency unless there's a conscious decision that this should be our role.

Current Literature

ALASKA PIPELINE

2146. **"Pipelines, Pollution and Prosperity in the Tundra"**, *Nature*, **v. 236, no. 5344, 31 March 1972, pp. 195-196.**

Presents the pros and cons of the Alaska pipeline, and discusses the possible alternative – the Canadian route – using as a basis the Department of Interior's detailed study of the situation (available from National Technical Information Service, Department of Commerce, Springfield, Va. 22151. Price: $30 for 6-volume environment statement; $12.50 for 3 additional volumes on economic and strategic analysis); concludes that no oil delivery system is entirely without environmental problems, and that the principal aim should be to reduce the environmental impact to an acceptable level.

2147. **Dingell, J. D., "The Alaska Pipeline Reading Lesson"**, *Congressional Record*, **v. 118, no. 60, 18 April 1972, pp. E3966-3968.**

Reprints a Wilderness Society pamphlet which strongly criticizes the Interior Department's attempts to avoid public hearings before a final decision on the construction of the pipeline is made; lists questions raised by the environmental impact statement dealing with such things as gas transportation systems, alternative routes, pipeline breaks, and economic, environmental, and security aspects to emphasize the need for public hearings.

2148. **"Alaska Pipeline Jumps the Gun"**, *Nature*, **v. 237, no. 5351, 19 May 1972, pp. 128-129.**

Presents criticisms by environmental groups of the decision by the Secretary of Interior Rogers Morton to grant right-of-way permits for construction of the trans-Alaska pipeline; chief criticisms concern the Department's rejection of the arguments contained in the groups' comprehensive critique of the impact report on the pipeline, and the failure to hold public hearings on the final impact statement which contained much new information.

ANTARCTICA

2149. *Report on United States Antarctic Research Activities, 1971-1972, and United States Antarctic Research Activities Planned for 1972-73*, **Report No. 14 to SCAR, Committee on Polar Research, National Academy of Sciences, National Research Council, June 1972, 82 pp.** (Available from Committee on Polar Research, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)

Lists the past and planned activities of the 8 U.S. Antarctic research stations in the atmospheric sciences, earth sciences, biology, and vessel operations by station, experiment, schedule, and personnel; lists the 8 types of activities of the NSF Polar Information Service and presents a 15-page bibliography of 1970-71 publications on U.S. Antarctic research.

ATMOSPHERIC SCIENCES

2150. *Inadvertent Climate Modification*, **M.I.T. Press, Cambridge, Mass. 02124, 1971, 308 pp.** ($2.95, Paperback)

Briefly recounts previous climatic changes and the hypotheses concerning their origin, as a background for assessing possible future changes; describes the major processes and parameters that govern climate, and the progress and problems of constructing numerical models of the global climate; discusses the climate changes that might result from such activities as increasing urbanization, injection of heat, particulates, and gaseous matter into the atmosphere, and removal of the arctic sea ice, and recommends establishment of an international monitoring and modeling program.

2151. *Project Skywater: 1971 Annual Report*, **U.S. Department of the Interior, Bureau of Reclamation, Atmospheric Water Resources Management Program, January 1972, 392**

pp. (Available from National Technical Information Service, Operations Division, Springfield, Va. 22151. Price: $3.00.)

Outlines briefly the concepts and hypotheses of precipitation management and the general activities and accomplishments of the program; presents reports of Bureau of Reclamation contractors summarizing their activities in areas such as weather modification, cloud seeding and physics, climatology, model studies, water resources development, radar, statistical analysis, and instrumentation.

2152. **"Government Scientists Investigate Natural and Manmade Water Vapor in Stratosphere"**, *U.S. Department of Commerce News*, **Release NOAA 72-77, 7 June, 1972,** 4 pp.

Describes an interagency project (NOAA, DOT, and NASA) aimed at determining how much water vapor is injected into the stratosphere by natural processes (thunderstorms, tropical upwelling, jet streams), where it goes, and how long it stays there; hopes are that the project will provide information which will help in determining whether water vapor pumped into the atmosphere by the jet engines of supersonic transports and other high-flying aircraft will affect the climate.

2153. **Purrett, L. A., "Weather Modification as a Future Weapon"**, *Science News*, **v. 101, no. 16, 15 April 1972, pp. 254-255.**

Discusses the current state of U.S. weather modification studies, and notes the combined efforts of Senator Pell and 13 other Senators to outlaw weather and climate modification as offensive weapons of warfare; outlines current weather-modification projects sponsored by DOD (e.g., the Nile Blue computer climate-modeling project), and describes various techniques being utilized for cloud seeding and fog dispersion.

AUSTRIA

2154. **"Austrian Science Budget for 1972"**, *Science Policy*, **v. 1, no. 2, March/April 1972, p.** 3.5.

Presents highlights of the 1972 budget which include: increases (over 1971 estimates) in total expenditure for science and research (2[illegible]%), in expenditures by general universities alone (14%), in the total budget for higher education establishments and for research (11%), and in total expenditure on research (32%).

2155. **"Austria to Cooperate More in International Research"**, *Science Policy*, **v. 1, no. 2, March/April 1972, p. 3.3.**

Describes Austria's plans for participating in international research projects, including 3 European projects (materials for use in gas turbines, seawater desalination plants, and the prevention of air pollution by sulfur dioxide), consultations with Switzerland on major research projects including multilateral projects such as those sponsored by the EEC, and probable participation in other EEC projects on telecommunications, a study of European transport facilities between main centers of industrial concentrations, and setting up a medium-term weather-forecasting center for Europe.

BANGLADESH

2156. **Afzal, S. A., "Science, Technology and Bangladesh"**, *New Scientist*, **v. 54, no. 793, 27 April 1972, pp. 196-197.**

Describes the need of all developing countries for a strong base of science and technology, and suggests that foreign aid be channeled in that direction; discusses, in particular, Bangladesh's need for the science and technology to exploit the Country's vast agricultural potential; to develop alternative sources of energy (perhaps solar and tidal) to augment the relatively meager supply of hydroelectric power; and for other research relevant to the needs of Bangladesh.

BIOLOGICAL SCIENCES

2157. **"U.S.-U.S.S.R. Medical Science and Public Health Agreement"**, *Weekly Compilation of Presidential Documents*, **v. 8, no. 23, 5 June 1972, pp. 19-20.**

Comprises 7 articles designed to develop and extend mutually beneficial cooperation in the field of medical science and public health; initial efforts will be directed toward combatting the most widespread and serious diseases (cancer and heart) and toward solving the problems associated with the effects of the environment on man's health.

2158. **Mondale, W. F., "Health Science and Society"**, *Congressional Record*, **v. 118, no. 48, 28 March 1972, pp. S4943-4959.**

Sen. Mondale presents a number of articles and editorials commenting on the present status of biomedical research, the ethical, legal, and social implications of advances in biomedical research and technology, the hearing on Senate Joint Resolution 75 to create a National Advisory Commission on Health, Science, and Society, and the need to move forward in a comprehensive but judicious manner in equipping society to deal with the ethical questions raised by biomedical research.

2159. **"AMA: Ethical Decisions in a Power Pocket"**, *Science News*, **v. 101, no. 25, 17 June 1972, p. 392.**

Outlines the medical-ethics subjects of growing concern to physicians and the public, for which the Judiciary Council of the American Medical Association is trying to establish guidelines: e.g., human experimentation, technological reproduction, *in vitro* fertilization and embryo transplantation, genetic engineering, and behavioral control; notes that while the AMA will probably not be taking an official position on these subjects for another year, articles appearing in *Journal of the American Medical Association* offer a clue as to what positions will be forthcoming.

2160. *The Mechanization, Automation, and Increased Effectiveness of the Clinical Laboratory*, **A Status Report by the Automation in the Medical Laboratory Sciences-Review Committee of the National Institute of General Medical Sciences, National Institutes of Health, DHEW Publication No. (NIH) 72-145, 1971, 77 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 70 cents.)

Assesses the current status of the clinical laboratory sciences, describing the significance of new developments in the field and identifying specific needs and areas needing further development, with the aim of aiding the scientific community in identifying the R&D projects needed to develop a completely automated clinical laboratory.

2161. **Mayer, J., "Decision Making in the Biological Field"**, *BioScience*, **v. 22, no. 3, March 1972, pp. 141-143.**

Describes various approaches to decision making – the problem-solving approach, the systems approach, and the regulatory approach – in the fields of health and food technology; recommends the systems approach instead of the ad hoc problem-solving approach, and suggests interdisciplinary study groups to examine proposed regulatory decisions.

2162. **"International Biomedical Engineering Program Receives Grant from Fannie E. Rippel Foundation"**, *AIBS News Release* **IBMEWS-2, 15 June 1972, 2 pp.** (Available from Ms. M.-F. Thompson, American Institute of Biological Sciences, 3900 Wisconsin Ave., N.W., Washington, D.C. 20016).

Announces a $25,000 grant for preparation and distribution of the individual output documents of 5 U.S.-Yugoslav International Biomedical Engineering Workshops funded by the National Science Foundation and held in Yugoslavia: (1) Biomedical Equipment Maintenance Service Programs, 16-22 April 1972, (2) Assistive Devices for the Disabled, 21-27 May 1972, (3) Technology for Mobile Care, 15-21 October 1972, (4) Communications Technology Applied to Medical Care, 12-18 November 1972, and (5) Improving the Effectiveness of Medical Care by Means of Applied Technology, 25-31 March 1973.

BUDGET FOR SCIENCE AND TECHNOLOGY

2163. **"Functions Other Than Defense and Space Show Rising Share in Federal R&D Expenditures"**, *Science Resources Studies Highlights*, **National Science Foundation, Report NSF 72-305, 25 April 1972, 4 pp.**

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Presents statistics revealing a decline in the joint share of defense and space research from 90% in 1966 to 77% of the Federal R&D total expenditures in FY 1973, and a rising trend in R&D expenditures for health, education and manpower, commerce and transportation, natural resources and environment (expected to receive the largest increase), agricultural and rural development, and community development and housing (expected to receive a moderate increase).

2164. *National Patterns of R&D Resources: Funds & Manpower in the United States, 1953-1972,* **National Science Foundation, Report NSF 72-300, December 1971, 34 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 50 cents.)

Analyzes past national R&D funding and manpower trends and presents estimated data for 1972; presents tables showing transfers of funds expended annually for performance of R&D, basic research, applied research, and development, and the sources of these funds.

2165. *Federal Funds for Research, Development, and Other Scientific Activities: Fiscal Years 1970, 1971, 1972,* **Surveys of Science Resources Series, National Science Foundation, Report NSF-71-35, v. XX, October 1971, 242 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00.)

Reports R&D obligations by agency and agency subdivisions, performers, character of work, and distribution of research funds by fields of science; also provides data on R&D plant, on scientific and technical information activities, general-purpose scientific data, and distribution of R&D funds by states; text and 5 appendixes contain numerous charts and tables.

2166. *The Federal Plan for Meteorological Services and Supporting Research, Fiscal Year 1973,* **Federal Coordinator for Meteorological Services and Supporting Research, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, January 1972, 70 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 70 cents.)

Describes the Federal Government's 1973 funding plans for providing meteorological services and research in the U.S. and for military operations overseas: a $481 million total expenditure, with almost $94 million earmarked for the research segment; the latter figure does not include such programs as weather modification, water resources, and air-sea interaction, which, along with other programs, would raise the research total to about $188 million; estimates operational costs at $397 million; assesses as closely as possible the costs and benefits of these activities.

2167. **"The Axe Falls",** *Nature,* **v. 237, no. 5356, 23 June 1972, p. 423.**

Discusses what might result from the Congress' recent decision to appropriate only $650.2 million for the National Science Foundation in FY 1973, instead of the $674.7 million required by the Foundation's plans; indicates that the House Appropriations Committee would like to see the budget for the RANN (Research Applied to National Needs) program trimmed to compensate for the cut, on the grounds that "support of short-term goals is indirectly cutting into support of established basic programs", such as institutional and graduate student support.

2168. **Hollings, E. F., "National Oceanic and Atmospheric Administration",** *Congressional Record,* **v. 118, no. 97, 15 June 1972, pp. S9481-9484.**

Discusses the inadequacy of the proposed fiscal year 1973 budget for NOAA (approximately $465 million), in the light of the vital tasks facing NOAA today: (1) development and operation of systems to monitor and predict weather, ocean, earth, and solar hazards; (2) development of programs to assure the wise, balanced use of the ocean and its resources; (3) exploration of the feasibility of weather modification and the consequences of man's inadvertent alteration of the climate; suggests a more realistic budget of approximately $55 million.

CANADA

2169. **"Select Committee Reaches the End of the Road",** *Nature,* **v. 236, no. 5344, 31 March 1972, p. 192.**

Reports on the final meeting of the Canada's Select Committee on Science and

Technology held to determine the exact nature of Britain's science policy; presents testimony of several witnesses as to the funding and decision-making processes of government science departments, which indicates that Britain considers a national science policy infeasible and is committed to a research councils' system and continuation of the Council for Scientific Policy.

2170. **Lithwick, N. H., "Technology & Progress: A Lesson the Senators Have Not Learned",** *Science Forum*, **v. 5, no. 2, April 1972, pp. 9-11.**

Criticizes proposals of Canada's Senate Special Committee on Science Policy for development of a new National Policy [presented in *A Science Policy for Canada*, Vols. I and II, see *SPR* 4(1):27 and 5(1):1755], charging that the Committee failed to heed past experience and to recognize the need for ensuring that future scientific and technological developments are relevant to society's needs.

2171. **Till, J. E., "How the Senate Report Proposals Would Affect Life Sciences in Canada",** *Science Forum*, **v. 5, no. 2, April 1972, pp. 11-13.**

Discusses specific recommendations presented in the reports mentioned in Ref. 2170 and their implications for the life sciences: (1) creation of a Life Sciences Foundation under which nonmedical and medical life sciences would have to compete for research funds; and (2) setting up of 3 institutes (life, physical, and social sciences) within a proposed National Research Academy, which would create budget conflicts for research management because of the diverse interests among the various departments within the respective institutes.

2172. **O'Lone, R. G., "Canada Weighs Arctic Resources Airlift",** *Aviation Week & Space Technology*, **v. 96, no. 21, 22 May 1972, pp. 25-26.**

Describes plans in Canada for studies of an elaborate transportation system, including a huge freighter aircraft as the initial element, for shipping mineral resources (chiefly oil and natural gas) from Canada's northwest and the high Arctic islands; the airlift system of transport is considered to be economically competitive with other modes including pipelines.

2173. **Wojciechowski, M., and Grove, J. W., "Looking Outward: The Changing Role of Scientific Societies",** *Science Forum*, **v. 5, no. 3, June 1972, pp. 29-31.**

Describes the close ties of Canadian scientists to Government Science, an association which has tended to make Canadian scientists relatively quiet on policy matters; discusses the increasing involvement of scientific societies with external activities and the resultant increased concern with science policy; examines the factors existing today which may force reorganization of the Canadian scientific community.

CHINA

2174. **Hieronymus, W. S., "U.S. Engineers Laud Chinese Expertise",** *Aviation Week & Space Technology*, **v. 96, no. 14, 3 April 1972, pp. 52-53.**

Presents an assessment of Chinese expertise by the 10-man team of U.S. engineers that installed and operated a communications satellite ground station in China to cover the Nixon tour; the general consensus was that the Chinese are advanced with regard to technological knowledge, but short on hardware; the Chinese tended to precede work with organization meetings, while U.S. technicians proceeded to carry out their previously designated responsibilities; the Chinese technicians were able to assist the U.S. team in many areas, though they appeared not to have the technology themselves.

2175. **Dean, G., "China's Technological Development",** *New Scientist*, **v. 54, no. 796, 18 May 1972, pp. 371-373.**

Presents discussions of a study group convened at the University of Sussex by the Science Policy Research Unit on "Science and Technology in China's Development", for the purpose of exploring the unique connection of science and technology with China's political system: large, modern enterprises are owned by the Central Government; at the regional level, enterprises tend to be of regional rather than national interest; and commune level enterprises tend to be small and use locally contrived technology; attributes the ability for sharing technology between enterprises and for protecting small-scale industries' market to the non-

competitive structure of the Chinese economy; emphasizes the practical aspects of technology, but notes that China's structure of science and technology is not necessarily suitable for other developing countries.

2176. **"Science in China: Continuity and Innovation"**, *Chemical & Engineering News*, **v. 50, no. 23, 5 June 1972, pp. 61-63.**

Reviews the U.S. Congress' Joint Economic Committee Report, "People's Republic of China: an Economic Assessment", and presents the principal conclusions: China has now regained the growth momentum of the period preceding the cultural revolution, has succeeded in alleviating the hunger problem by a modest "green revolution" and an active birth-control policy, and has been moderately successful in allocating scarce resources among the many demands of civic, industrial, and military sectors; observes that the R&D is directed toward the practical rather than toward basic research, and that while emphasis is on worker-peasant science and on innovation, Western technology is not ignored.

2177. **Galston, A. W., "The University in China"**, *BioScience*, **v. 22, no. 4, April 1972, pp. 217-220.**

Describes Chinese society as background for understanding the organization of universities today; explains how a secondary-school graduate works for 3 or 4 years and then may be nominated for university entry graduates then return to the jobs from whence they came; points out that the Cultural Revolution precludes basic research in favor of efforts to provide for the needs of the people; all decisions are made by tripartite Revolutionary Committees (political, military, and labor representation), which run everything from factories and universities to municipalities; concludes that ultimately China will have a sizeable class "whose job it will be to do basic research" as a foundation for further "leaps forward".

COMMUNICATIONS

2178. **Klass, P. J., "ESRO Exploring Regional Satcom"**, *Aviation Week & Space Technology*, **v. 96, no. 20, 15 May 1972, pp. 59, 61.**

Describes a newly initiated broad program, sponsored by the European Space Research Organization to develop technology required for a European regional communciations satellite system to meet a tentative launch date of mid-1979; outlines the specific objectives of the program in the areas of communications technology, structures and mechanisms, attitude and orbit control, energy conversion, and thermal control; and describes the advantages of the satellite system over Europe's present terrestrial land-line and microwave network.

2179. **Elson, B. M., "More Attention to Satcom Users Urged"**, *Aviation Week & Space Technology*, **v. 96, no. 24, 12 June 1972, p. 48.**

Reviews statements made at the U.S.-European Eurospace conference in San Francisco, at which governments, international agencies, and aerospace companies were challenged to convert space systems into useful instruments for solving the earth's problems; topics discussed included: the need for the aerospace industry to help develop software programs for the use of communications satellites for educational purposes; and India's plans to use satellites for educational television beginning in 1974, at which time the U.S. National Aeronautics and Space Administration ATS-F satellite will be used to beam programs into more than 4,000 villages throughout India.

2180. **Johnsen, K., "FCC Plans Satcom Decision This Month"**, *Aviation Week & Space Technology*, **v. 96, no. 20, 15 May 1972, pp. 65, 67.**

Summarizes the reactions by the Justice Department, the Office of Telecommunications, and the various applicants to the FCC's Common Carrier Bureau's recommendations for a domestic satellite communications system; chief objections were directed against a forced merger of the systems proposed by Hughes Aircraft/GTE (jointly) and Western Union Telegraph, and against participation by AT&T.

2181. **Bellmon, H., "Communications Technology May Produce New Rural Society"**, *Congressional Record*, **v. 118, no. 72, 10 May 1972, pp. S7890-7892.**

Sen. Bellmon discusses the problems caused by the large flow of population from rural to urban and suburban communities; presents an article by Dr. P. C.

Goldmark proposing a new communications network linking satellites and community antenna television to provide the entire U.S. with far-reaching entertainment, cultural, and educational services, and explaining how such a communications system could reverse the trend and possibly produce a new "Rural Society".

2182. *Communication Innovations: Urban Form and Travel Demands* (Available from Council of Planning Librarians, P.O. Box 229, Monticello, Ill. 61856. Price: $6.50.)
Analyzes possible effects of urban growth patterns and urban travel demands; speculates that downtown office employment might decentralize if telecommunications could effectively substitute for short interoffice business trips; includes an extensive bibliography.

2183. **Parker, E. B., and Dunn, D. A., "Information Technology: Its Social Potential",** *Science*, **v. 176, no. 4042, 30 June 1972, pp. 1392-1399.**
Describes the state of the art of 2-way cable television and communications satellites, and how these, coupled with modern video cassettes and computer information systems, could be used to create an industry-funded "information utility" that would be available to most U.S. homes by 1985; it would provide anyone, on demand, with information, entertainment, news, library archives, and educational programs, giving everyone equal opportunity and stimulating the economy through gains in productivity resulting from better and more widespread education; calls for Federal efforts in coordination, policy analysis and assessment, and pilot projects and demonstrations.

2184. **Fawcett, J.E.S., "Science and the Law: Communications Satellites",** *New Scientist*, **v. 53, no. 789, 30 March 1972, pp. 701-702.**
Describes the nature of law, national and international, and its enforcement with relation to communications satellites; demonstrates how the law functions in satellite broadcasting by considering each of 5 elements: operations, access, orbit, frequency, and power; includes a historical review of international agreements leading to Intelsat and Intersputnik systems.

2185. **Thompson, G. B., "The Environment, Society, and Communications",** *Vital Speeches of the Day*, **v. 38, no. 16, 1 June 1972, pp. 503-507.**
Discusses communication planning procedures and the matters which should be considered in future communications services; suggests that any communications future should incorporate positive utility; points out that "there is really no difference between social and economic effects" of communication since they are interactive, and outlines the characteristics or "dimensions" of the significance of communications innovations, based on social effects.

DEVELOPING COUNTRIES

2186. *Electric Power: Sector Working Paper*, **World Bank, December 1971, 23 pp.** (Available from Information Office, World Bank, 1818 H St., N.W., Washington, D.C. 20433.)
Discusses the implications of the rapidly growing demand for electric power in developing countries, with emphasis on economic factors.

2187. **Yudelman, M., Butler, G., and Banerji, R.,** *Technological Change in Agriculture and Employment in Developing Countries*, **Organisation for Economic Co-operation and Development, January 1972, 208 pp.** (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $5.00.)
Examines the process of technological change in agriculture, and stresses the importance of not copying Western-style agricultural development; describes the effects of technological change on labor utilization in agriculture, the transfer of agricultural technology, and the need for developing an indigenous technology.

2188. *Air Management Problems and Related Technical Studies: Policy Report of the Air Management Research Group*, **Organisation for Economic Co-operation and Development, February 1972, 192 pp.** (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $4.95.)
Presents in part one a general review of problems related to the formulation and implementation of policies for pollution control in OECD countries, describing the changes taking place, the role of the national government, the conflicting interests

relevant to government policy issues, and the need for international action; part two consists of studies on specific aspects of the air-pollution problem.

2189. **"Information as a Key to Progress"**, *OECD Observer*, **no. 57, April 1972, pp. 6-8.**
Discusses the OECD countries' lack of a coherent, comprehensive policy covering the entire range of necessary scientific, technological, economic, and sociological information, and recounts efforts of the OECD Committee for Science Policy to help OECD countries define such a policy; examines the need for (1) a national focus responsible for coordinating and managing information sources, (2) a closer link between departments responsible for scientific and technical policy and the national focus, and (3) establishing a compatible network for exchange of information; describes difficulties of obtaining skilled information specialists and the inadequate training of the users of information systems.

2190. **"Developing Countries: Financial Resources for Science and Technology"**, *Science Policy*, **v. 1, no. 2, March/April 1972, p. 1.5.**
Pinpoints the targets for financial support of science and technology in developing countries: to attain a minimum level equal to 1.0% of their GNP on sums allotted to science and technology, with at least half of this earmarked for research and experimental development; suggests limiting the 5-year rate of increase in national expenditures to 15% per year, to allow building and organization of the infrastructure of research institutions and education and training of scientific workers to keep pace; recommends an average level of direct support by developed countries equivalent to 0.05% of their GNP.

2191. **"Science and Technology Assistance Levels in Latin America"**, *International Science Notes*, **no. 27, May 1972, pp. 8-10.**
Presents tables showing amount of funds expended on science- and technology-related activities in Latin America which are either supported by the U.S. Government directly or by multilateral organizations in which the U.S. is a major participant; gives details of expenditures by various U.S. Government-assisted institutions and agencies, which show A.I.D. to have the highest funding level ($10.8 million in grant projects).

2192. **"East-West Conference on Technology, Development and Values"**, *Center Report*, **v. V, no. 3, June 1972, pp. 8-9.**
In a 3-day Center conference it was brought out that industrialization is not necessarily accompanied by reduced unemployment; proposals included an "intermediate technology" for the less-developed countries to forestall a repetition of development patterns of industrialized nations, and a three-level combination of technologies: (1) cottage-type industries, (2) intermediate ("labor-intensive") technology, and (3) large, western-style technology to develop national communications, energy systems, etc.

ECONOMICS AND SCIENCE

2193. **Mansfield, E., "R&D's Contribution to the Economic Growth of the Nation"**, *Research Management*, **v. 15, no. 3, May 1972, pp. 30-46.**
Examines the relationship between R&D and economic growth in the U.S.; questions the reliability of present estimates of the contribution of R&D, noting the limitations of methods used to derive them; concludes that we may be underinvesting in R&D in the civilian sector of the economy and that the rate of return from additional R&D in that sector is quite high.

2194. **Harr, K. G., Jr., "High Technology in the Government"**, *Congressional Record*, **v. 118, no. 19, 6 June 1972, pp. E6021-6022** (Reprinted from *Professional Engineer*, April 1972).
Points up the need of some form of cooperative endeavors between the U.S. Government and industry to maintain sufficient R&D to assure that high technology products are developed and competitive in the world marketplace; reviews the history of U.S. international trade, and notes the rapidly increasing competitive market the U.S. is now facing.

2195. **Wakelin, J. H., Jr., "Government's Role in Our Technological Development"**, *U.S.*

Department of Commerce News, 13 April 1972, 9 pp.

Examines the serious deterioration in the U.S. trade position and describes the relationship of technology to trade; discusses the various approaches for greater Government encouragement of technology being considered by the Commerce Department, and summarizes some general concepts which seem to offer promise: venture research, business-community research, and transfer of Government-owned technology into the civilian technology.

2196. **Seiberling, J. F., "The Case for Economic Conversion"**, *Congressional Record*, v. 118, no. 95, 13 June 1972, pp. E6177-6179.

Rep. Seiberling discusses how the U.S. can move from dominance by the "military-industrial" complex to the "peace-industrial" complex by changing the pattern of Government spending; discusses the employment problems facing aerospace scientists and engineers, and calls for the Government to create a market for products from peace-oriented industry, not only to provide jobs for these unemployed but also to improve productivity and the sagging U.S. economy.

2197. **O'Lone, R. G., "Washington, Boeing Push Diversification"**, *Aviation Week & Space Technology*, v. 96, no. 25, 19 June 1972, pp. 53-55.

Outlines the bond issues comprising the "Washington Future" program, to be presented for voter approval this fall, which represents an attempt at diversification in the State of Washington; describes ventures into nontraditional areas by Boeing Co. (Seattle), such as transportation, housing, irrigation, and computer services.

2198. **Halpern, S., "Worldwide Pollution Controls and H.R. 13116"**, *Congressional Record*, v. 118, no. 88, 1 June 1972, pp. H5181-5182.

Rep. Halpern introduces a bill calling for the creation of a Commission on International Trade and the Environment, charged with determining answers to questions relating to industrial antipollution measures and their economic consequences; findings would not only aid in formulating U.S. environmental policies, but would also provide data needed for harmonizing the environmental policies of all nations and keeping world trade conditions on an even keel.

EDUCATION

2199. *Cornell Program on Science, Technology, and Society*, 1972, 23 pp. (Available from Program on Science, Technology and Society, 628 Clark Hall, Cornell University, Ithaca, N.Y. 14850.)

Describes the STS program and presents a course listing for 1972-73, under two categories: interdisciplinary courses cosponsored by STS, and related disciplinary courses.

2200. **Sanders, H. J., "Two-Year Master's Program in Engineering"**, *Chemical & Engineering News*, v. 50, no. 20, 15 May 1972, pp. 15-16.

Reports the establishment of 2-year master's programs in engineering at Carnegie-Mellon University, which will initially specialize in either environmental studies or processing; the new programs will be interdisciplinary in that they will attract students with bachelor degrees in several fields (primarily chemical and mechanical engineering) and will provide an unusually large amount of interaction between students and engineers or scientists in outside, nonacademic institutions.

2201. **"Flexibility is Key to BS Program at IIT"**, *Chemical & Engineering News*, v. 50, no. 20, 15 May 1972, pp. 16-17.

Describes new programs introduced at Illinois Institute of Technology, leading to the new degree of bachelor of science in engineering sciences (BSES) and designed to provide flexible degree programs that give individuals greater freedom to engage in interdisciplinary and special academic studies, while meeting the basic requirements (mathematics, science, and engineering courses).

2202. **"New School of Public and Environmental Affairs"**, *Indiana Alumni Magazine*, May 1972, pp. 15-16.

Presents details of Indiana University's new academic program which represents an all-out effort by the University, working with the community, to relate its

programs and resources more directly to the public-sector needs of society; initial programs are public-administration oriented, while at the graduate level, students studying environmental management will have some background in the applied sciences; the School has established a Research Division (to be involved in public policy research) and a Division of Technology Applications (with the mission of transferring information to the private and public sector of the economy).

2203. **"Center for Policy Alternatives"**, *Chemical and Engineering News*, **v. 50, no. 19, 8 May 1972, pp. 23-24.**

Announces the establishment of a Center for Policy Alternatives in MIT's school of engineering, where experts from various disciplines at MIT and from industry, government, and other universities will combine their talents to investigate issues relating to society, particularly those wherein technology and engineering could play a significant part; alternatives will be developed and means for their implementation identified.

2204. **"Innovation in Science/Engineering Education"**, *Washington Science Trends*, **v. 28, no. 7, 22 May 1972, p. 39.**

Announces a new experimental program being initiated at the Worcester (Mass.) Polytechnic Institute, under which traditional course and degree requirements will be replaced by "demonstrations of competence"; students will be required to show competence by completing independent study projects and undergoing an evaluation process. (For further information, contact W. R. Grogan, Dean of Undergraduate Programs, Worcester Polytechnic Institute, Worcester, Mass. 01609.)

2205. *Engineering and Technology Enrollments, Fall 1971*, **1972, 140 pp.** (Available from Engineers Joint Council, Department P, 345 East 47th St., New York, N.Y. 10017. Price: $20.00.)

Presents detailed statistics on enrollment at all levels in 282 engineering schools and 625 institutions offering technology or pre-engineering programs, including tables listing statistics for women, U.S. Negroes, and foreign students.

2206. **"First-Year, Full-Time Graduate Science Enrollment Continues to Decline"**, *Science Resources Studies Highlights*, **NSF Report 72-308, 25 May 1972, 4 pp.** (Available from National Science Foundation, Division of Science Resources Studies, Washington, D.C. 20550.)

Summarizes findings from 2990 doctorate-granting departments enrolling 182,000 graduate science students in 1971: first-year, full-time enrollment dropped 5% from 1970 and 7% from 1969, the decreases occurring in virtually all areas of science; largest drops (8%) were in "top 20" institutions (chosen by number of NSF fellows and Federal R&D dollars); about 10% fewer full-time graduate students were supported primarily by fellowships and traineeships in 1971 than in 1970; full-time graduate faculty increased 1% from 1970 to 1971, while post-doctoral appointees increased 5%.

2207. **"Continuing Education Shifts to Newer Forms"**, *Chemical & Engineering News*, **v. 50, no. 16, 17 April 1972, pp. 29-30.**

Discusses in-house industrial programs designed to combat technical obsolescence; describes courses and methods used by Bell Labs, Eastman Kodak, and Du Pont; Du Pont's philosophy of continuing education is based on a systems approach, taking into consideration the impact of technology on political, social, and economic systems.

2208. **Pilcher, P. C., "Education for a Changing Society"**, *Vital Speeches of the Day"*, **v. 38, no. 15, 15 May 1972, pp. 461-463.**

Discusses the underlying factors contributing to the extension of the educational process into adulthood: the information explosion, increased leisure time, and greater longevity; asserts that education must now be recognized as a life-long process, citing estimates which reveal that by 1976, more than 82 million adults will be taking part in education programs outside the traditional school system; suggests approaches to fulfilling this need, through new instructional concepts (such as educational television) and the linking of library resources by electronic means.

2209. **"Dim Light at the End of the Tunnel"**, *Nature*, **v. 237, no. 5355, 16 June 1972, pp. 365-366.**

Presents the major provisions of the Higher Education Bill passed by the U.S.

Congress in June, 1972, which could channel $18,500 million into universities and colleges over the next 3 years; describes the strong division of opinion among the academic community on the merits of the bill, particularly with regard to institutional grants, which are to be awarded on the basis of the number of federally supported students from low income groups attending each college; discusses the controversy over the antibusing provisions, which delayed passage of the bill.

2210. **Walsh, J., "National Institute of Education: New Direction for Education R&D", *Science*, v. 176, no. 4041, 23 June 1972, pp. 1310-1312.**

Reviews the history of the National Institute of Education concept, outlining actions taken to promote it; notes that education R&D is meagerly financed in relation to the size of the educational enterprise ($200 million/year versus almost $70 billion annually); describes the responsibilities of the new National Institute of Education created by the education authorization bill: to foster basic and applied research, development, and demonstration projects and to carry out effective dissemination of useful results.

2211. **Hammond, A. L., "Computer-Assisted Instruction: Many Efforts, Mixed Results", *Science*, v. 176, no. 4038, 2 June 1972, pp. 1005-1006.**

Discusses the educational areas in which computer-assisted instruction (CAI) has been given: primary education, university classrooms (for complete or parts of courses), and vocational and military training; cites the major hindrances to the use of CAI on a broad scale (high cost, institutional resistance to change, and technical problems with the systems); notes two major efforts to demonstrate the efficacy of CAI – the Ticcet system being developed by the Mitre Corp. in collaboration with the University of Texas and Brigham Young University, and the Plato system being developed by the University of Illinois.

2212. **Hannah, J. A., "Applying a New Dimension of Education in the Developing Countries", *U.S. Department of State Bulletin*, v. 66, no. 1719, 5 June 1972, pp. 786-789.**

Explores 3 questions: the role and purpose of the U.S. foreign assistance program, the kind of assistance program that the U.S. should have, and the wisdom of continuing foreign assistance in the post-Vietnam era when the U.S. has serious domestic problems that obviously need attention; describes the U.S.'s present development assistance program which is geared to basic human problems; and examines the potential of out-of-school learning and the importance of education in underdeveloped countries.

2213. ***Joint Efforts of School Systems and Colleges to Improve Science and Mathematics in the Schools, 1972 Directory*, National Science Foundation, Publication E-72-P-23, 1972, 24 pp.** (Available from Cooperative College-School Science Program, PES Division, National Science Foundation, Washington, D.C. 20550.)

Describes and catalogs the 1972-73 projects in he $4.5 million program under which colleges, universities, and similar institutions can work with school systems and teachers in improving elementary and secondary science and mathematics courses.

2214. **"Graduates Get Good Training, Education, but –", *Chemical & Engineering News*, v. 50, no. 26, 26 June 1972, p. 12.**

Describes discussions which took place at a 1-day conference on training of chemists for the 1970's, sponsored by the University of Delaware Chemistry Department, and which dealt with graduate attitudes toward industry and graduate training; one participant notes that the attitude of graduates in selecting objectives, carrying them out, evaluating work, and communicating work needs to be improved, but that educators who lack industrial experience may not know how to help them; another suggests that there should be more communication between the university and industry, in order to effect substantive changes in educational philosophy.

ENERGY – CRISIS

2215. **"Proposals Aim to Solve Energy Shortage", *Chemical & Engineering News*, v. 50, no. 15, 10 April 1972, p. 2.**

Describes proposals advanced by private enterprise to help meet the growing U.S. energy needs and lessen U.S. dependence on fossil fuels: a privately owned uranium-235 enrichment plant, a nuclear gas turbine power plant, and a satellite system in space to convert sunlight to electrical power.

2216. **Hansen, C. P., "Energy and Power Crisis"**, *Congressional Record*, **v. 118, no. 59, 17 April 1972, pp. S6175-6183.**

Presents and discusses briefly a collection of articles from the *Washington Post* and the *Washington Evening Star* dealing with U.S. dependence on foreign oil and gas supplies, as well as the need for a national energy policy, and assessing the environmental crusade; views domestic oil and gas as the U.S.'s lowest cost source of dependable energy for the foreseeable future, and urges support of efforts to find and develop both onshore and offshore deposits.

2217. **Irwin, J. N., II, "The International Implications of the Energy Situation"**, *U.S. Department of State Bulletin*, **v. 46, no. 1714, 1 May 1972, pp. 626-631.**

Examines the international energy situation, citing projected energy demands for the U.S., Japan, and western Europe, and describes the outlook concerning future oil and natural gas supplies; discusses the economic effects of recent oil agreements, and describes the efforts of the U.S. and other countries to obviate dependence on foreign energy supplies.

2218. **Evins, J. L., "Nation Faces Power Crisis"**, *Congressional Record*, **v. 118, no. 77, Part II, 11 May 1972, pp. E5159-5160.**

Deplores the delay in the building of nuclear power plants in the U.S., citing a great need for such plants; warns of a severe power shortage this summer, possible fuel and power rationing eventually, and a likely backlash against the environmental movement; suggests that the public conserve energy whenever possible and that the U.S. stop exporting resources that require huge energy outputs.

ENERGY – ENVIRONMENT

2219. **Alfven, H., "Energy and Environment"**, *Bulletin of the Atomic Scientists*, **v. 28, no. 5, May 1972, pp. 5-10.**

Describes the chief alternatives to fossil fuels as an energy source – fission, fusion, and solar energy – and their possible limitations; defines our immediate needs and delineates areas requiring further development; views the struggle for energy sources as a major factor in world policy, and suggests establishment of an international institute ("world energy agency") to plan a world energy policy in a rational, realistic way.

2220. **"AEC Division Reorganized to Emphasize Environmental Research"**, *AEC News Releases*, **v. 3, no. 24, 14 June 1972, p. 4.**

Reports the reorganization of the Atomic Energy Commission's Division of Biology and Medicine so as to emphasize research needed to assess the biological and environmental costs of energy generation; it has been renamed the Division of Biomedical and Environmental Research, and a major feature is the establishment of a new position – Assistant Director for Environmental Sciences, who is responsible for the E[illegible]iences Branch and the Earth Sciences Branch; the Division's research bu[illegible]illion annually, about $60 million of which is spent at AEC laborator[illegible].

2221. **Schlesinger, J. R., "Energy, T[illegible] Environment and Society"**, *AEC News Releases*, **v. 3, no. 17, 26 April 1972, pp. 7-10.**

Describes the energy dilemmas related to fuel supplies, power plant siting, efficiency of energy production and utilization as it impacts on environmental quality, and the appropriate combination of technologies to obtain higher efficiencies; presents suggestions concerning directions for an energy policy, and emphasizes that energy supplies and demands, economics, and environment risks versus benefits must be fully considered in developing an energy policy if it is to be coherent and effective, with the means consistent with the goals.

2222. **Doub, W. D., "In the Public Interest: A Mandate for Clean Energy"**, *AEC News Releases*, **v. 3, no. 19, 10 May 1972, pp. 7-10.**

Describes the obligations of public utilities commissions and the power industry in meeting the public's demand for sufficient power with minimum environmental impact; stresses the need for increased investment in clean-up technologies and in R&D, and the desirability of consumer education regarding ways to conserve energy through more efficient use.

2223. **Larson, C. E., "Energy and the Environment",** *AEC News Releases,* **v. 3, no. 21, 24 May 1972, pp. 4-8.**

Discusses the immediate energy crisis of acute shortages of electric power and natural gas in certain areas of the U.S.; suggests that society stop wasting energy, develop nuclear power, and consider using the electric motor as an alternative to the internal combustion engine; discusses energy conversion technologies such as those connected with magnetohydrodynamics, fuel cells, solar, tidal, geothermal, and fusion; discusses the economic aspects of the fast breeder reactor and the environmental impact of nuclear power generation.

2224. **"Four Research Grants Awarded by Utilities",** *Mechanical Engineering,* **v. 94, no. 6, June 1972, p. 77.**

Announces the award of grants by the Middle Atlantic Power Research Committee to four schools (Newark College of Engineering, University of Pennsylvania, Pennsylvania State College, and Lafayette College) for research on specific problems which confront electric utilities; according to D. Weiss, Chairman of the Committee, "this year's grants reflect the utility industry's continuing concern with the complex . . . problems determined by the environment, ecology, and equipment reliability".

2225. **Wei, J., "Energy, The Ultimate Raw Material",** *Chemical Technology,* **March 1972, pp. 142-147.**

Asserts that there is no such thing as a nonrenewable mineral, and that with sufficient expenditure of energy, the ultimate raw material, everything can be recovered; compares production and consumer costs of various forms of energy; examines crises facing energy use today: shortage and environment; concludes that there is no collision course between high energy use and good environment, pointing out that there are technological solutions to pollution.

2226. **Quarles, J. R., Jr., "Remarks to Edison Electric Institute's Eighth Biennial Financial Conference",** *Environmental News,* **16 May 1972, 12 pp.**

Discusses the energy crises, the conflicts between power supply and environmental protection, and the obstacles to reconciling the two objectives; describes the need for power plant citing criteria as a starting point for avoiding future environmental problems; pinpoints the obligations of the power industry: to provide adequate power generating capacity, with due emphasis on the environmental aspects.

ENERGY – FUEL SUPPLY

2227. **"Major Effort for Coal Gasification",** *Mechanical Engineering,* **v. 94, no. 6, June 1972, p. 37.**

Describes a development program to turn coal into low-heat-content gas for use in the generation of electricity, with the goal of having an advanced gasification system commercially available by 1980; the team involved in this effort comprises Public Service Indiana, AMAX Coal Co., Bechtel Corp., and Westinghouse, with support from Northern Indiana Public Service, Tennessee Valley Authority, and Consumers Power Co., and hopefully with financial support from the Federal Government.

2228. **Randolph, J., "Federal Efforts to Develop and Demonstrate New and Environmentally Acceptable Means for Electric Power Generation, Using Coal, Seem to be Inadequate",** *Congressional Record,* **v. 118, no. 52, 5 April 1972, pp. E3425-3436.**

Sen. Randolph discusses the U.S. energy crisis, emphasizing fossil-fuel shortages, emission standards, and the R&D being done to provide cleaner energy from fossil fuels; presents an EPA analysis of fossil-fuel alternatives to eastern coal and a letter from the President of Bituminous Coal Research, Inc., pointing out that intensive R&D is needed to reduce coal sulfur contents and that low-Btu gas looks like the best long-range bet; describes Environmental Protection Agency research,

development, and demonstration programs dealing with energy use, and says EPA's efforts have been "totally inadequate considering the anticipated impact of proposed and existing air pollution standards on Appalachian and Interior region coal supplies".

2229. **Moss, F. E., "Energy and Oil Shale",** *Congressional Record,* **v. 118, no. 76, 10 May 1972, pp. S7574-7575.**

Sen. Moss describes the activities at a forum on "Synthetic Energy – The Immediate Outlook", sponsored by the *Oil Daily,* at which executives from energy industries spoke on topics concerning the energy crises; presents the text of a talk by M. M. Winston, president of the Oil Shale Corp., in which Winston reviews the present status of oil shale development for energy use, its economic aspects, and its ability to fulfill future energy demands; Winston announces that final economic analysis for the commercial development of shale oil will be ready in late 1972, and that commercial production of shale oil in the U.S. should begin in 1976.

2230. **Lawson, H. G., " 'Plowshare' Payoff?: The Nuclear Blasting of Gas Wells Appears Near Commercial Use",** *Congressional Record,* **v. 118, no. 93, 8 June 1972, pp. E6079-6080** (Reprinted from June 8 *Wall Street Journal*).

Describes recent developments in Plowshare – a program to release underground natural gas by nuclear explosions – which would cut down greatly on the amounts of residual radioactive materials left in the wells by the explosion, and consequently on the amount of radioactive materials in the extracted gas; discusses what must still be done before Plowshare becomes commercial, and describes opposition by environmentalists, the Oil Shale Corp., and the public.

ENERGY – NATIONAL POLICY

2231. **"Energy Conservation 'Targets' ",** *Washington Science Trends,* **v. 28, no. 7, 22 May 1972, pp. 37-38.**

Presents the views of E. E. David, Jr., Presidential Science Adviser, concerning the proper approach to energy conservation; David advocates optimum use of available energy supplies through design, particularly in the space conditioning area in specific segments of industry (e.g., steel and iron, petroleum refining); identifies the top four end uses – transportation, space heating, industrial process steam, and direct industrial heat – which account for 70% of our energy consumption; outlines the design options for space conditioning and suggests that efficient energy usage in industry can be achieved through greater engineering efforts and the recovery and reuse of scrap metals.

2232. **Bagge, C. E., "Coal: An Overlooked Energy Source",** *Vital Speeches of The Day* **v. 38, no. 12, 1 April 1972, pp. 370-376.**

Examines the potential of coal as a clean source of energy through the application of new technology such as gasification, liquefaction, and solvent refining, and through development of advanced concepts such as the fuel cell, the magnetohydrodynamic system, and gas turbine cycling; emphasizes the need for a national energy policy, the keystone of which must be the full development and use of coal, our most abundant and safest domestic fuel.

2233. **Baddour, R. F., "A National Need for Process Innovation in the Fossil Fuels Industry",** *Congressional Record,* **v. 118, no. 92, 7 June 1972, pp. S8919-8921.**

Presents the technological case for Federal leadership in developing process innovation in the extraction and use of U.S. fossil fuel energy resources; describes the present and future demands for the various fuels, and discusses the importance of maintaining a secure domestic energy supply.

2234. *United States Energy: A Summary Review,* **U.S. Department of the Interior, January 1972, 42 pp.** (Available from U.S. Department of the Interior, Office of Oil and Gas, Washington, D.C. 20240.)

Presents facts and information upon which to base judgments and decisions concerning energy policies, and which reveal the dimensions of the energy crisis in the U.S.; examines national objectives with regard to energy, environmental control, consumer protection, conservation, national security, and international trade;

describes energy requirements and energy resources and supply problems; includes a glossary and a selected bibliography.

2235. **Abrahamson, D. E.,** *The Energy Crisis: Some Policy Alternatives,* **USAEC Report LA-4895-MS, Los Alamos Scientific Laboratory, February 1972, 13 pp.** (Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22151. Price: $3.00.)

Examines the many factors to be considered in establishing a national energy policy, including economic growth, environmental and social costs, and reliability of fuel supplies; suggests establishment of a fuels policy as the first step toward determining an energy policy.

2236. **Schlesinger, J. R., "Energy, The Environment, and Society",** *Congressional Record,* **v. 118, no. 63, 21 April 1972, pp. E4152-4154.**

Reviews the many factors leading to "energy dilemma" in the U.S., the overall energy balance, and the prospective trends in energy supply and demand; emphasizes the public's right to determine goals, select a mix of measures to achieve these goals, and choose among alternatives, but warns that haphazard choice, based on immediate emotion, is potentially crippling.

2237. **Wilson, R., "Power Policy – Plan or Panic",** *Bulletin of the Atomic Scientists,* **v. 28, no. 5, May 1972, pp. 29-30.**

Presents personal views regarding the current status and future possibilities of the various power sources, including oil, gas, coal, and fission, fusion, and solar energy; suggests possible areas for public action, relating to programs promoting the sensible use of energy, design of buildings to use solar heat and minimize the need for air conditioning, a tax on air conditioners and thermal pollution, encouragement of international cooperation, and increased research on fusion reactors, solar power, and geothermal power.

2238. **Randolph, J., "Realistic Federal Energy Research Priorities Are Needed",** *Congressional Record,* **v. 118, no. 100, 20 June 1972, pp. S9789-9790.**

Discusses the U.S.'s urgent need for a secure energy source for the near future, pointing out that "we must successfully meet the requirements of the 1970's and 1980's when there will be need for the development of sulphur oxide control technology, both high- and low-Btu coal gasification, and geothermal energy sources", as well as improved efficiencies in the conversion and end uses of energies; recognizes that the long-term posture depends on successful development of solar energy, nuclear breeders, and controlled fusion; argues for increased Federal and industry support of energy R&D.

2239. **Schlesinger, J. R., "Energy Policy and Energy R&D", Remarks before the 55th Annual Convention of the National Coal Association,** *AEC News Releases,* **v. 3, no. 25, 21 June 1972, pp. 4-7.**

Emphasizes the need for decisive action in the energy field and on the problems of developing and implementing a coherent set of energy policies; discusses the prospects and problems of using scientific and technological capability to work effectively on energy development; describes the diverse nature of the research carried out in Atomic Energy Commission Laboratories.

2240. **"Congress Probes U.S. Energy R & D Policy",** *Congressional Record,* **v. 118, no. 3, 23 June 1972, p. 6453.** (Reprinted from *Chemical and Engineering News,* 12 June 1972.)

Reviews the work of the House Subcommittee on Science, Research, and Development, and its Task Force on Energy, which resulted in publication of an "Inventory of Energy Research", compiled by Oak Ridge National Laboratory with NSF funds; describes the fragmented management efforts in the Executive and Legislative branches of the Federal Government, and recommends consolidation of all energy R & D activities into one agency – the AEC, as well as sharply increased spending for nonnuclear R & D.

2241. *Energy Technology to the Year 2000,* **A Special Symposium, 1972, 97 pp., published by** *Technology Review,* **Room E 19-430, M.I.T., Cambridge, Mass. 02139.** ($1.95)

Reprints 10 articles covering the relation between energy, the economy, and the environment; electric power from nuclear fission; geothermal energy sources; energy and pollution; and energy sources and uses; these appeared in 3 issues of

Technology Review, and some were abstracted in earlier *SPR's* [see *SPR* 4(4):1434 and 1442, 5(1):1832 and 2113.]

2242. **"Energy Conferees Identify Issues for Achieving Clean, Economical, and Secure Energy Supply"**, *Mechanical Engineering*, **v. 94, no. 6, June 1972, pp. 71-72.**

Presents statements made by speakers at a conference on nergy and public policy held April 19-20 in New York City, stressing the urgent need for a firm national energy policy in the U.S.; other actions suggested include: research and development of domestic energy sources, decontrol of the price of natural gas at the wellhead to encourage exploration and development of new gas supplies; fewer government restrictions on gas companies to permit development of supplemental sources; fixing the authority and responsibility for regulations and establishment of priorities; subjection of environmental considerations to the same standards and scrutiny as required of technology.

ENERGY – NUCLEAR

2243. **Hammond, A. L., "The Fast Breeder Reactor: Signs of a Critical Reaction"**, *Science*, **v. 176, no. 4033, 28 April 1972, pp. 391-392.**

Discusses questions being raised concerning the economic feasibility, optimum design, and environmental hazards of the LMFBR; questions the advisability of a crash program to develop a technology in such a crucial area as the future source of energy, and calls for a halt in the program until these issues have been resolved.

2244. **Gravel, M., "Nuclear Power: What is the Meaning of Recent Votes?"**, *Congressional Record*, **v. 118, no. 84, 24 May 1972, pp. S8355-8358.**

Discusses the significance of the recent passage of the interim licensing bill by Congress: viz., members are not as yet prepared to impose a moratorium on the licensing of nuclear power plants; strongly recommends such a moratorium, citing in support the major unresolved problems of nuclear power, including: design deficiencies (ECCS), haphazard quality control, radioactive-waste storage, and vulnerability of power plants and fuel processing plants to sabotage; reprints an article from the *Environmental Law Journal*, Northwestern School of Law, Winter 1971, which upholds this view.

2245. **Gravel, M., "Crisis in Nuclear Fission: A Hard Way to Boil Water"**, *Congressional Record*, **v. 118, no. 69, 1 May 1972, pp. S7006-7007.**

Reprints an article from *Nucleonics Week* (April 20) and cites an editorial, both of which express doubts concerning the adequacy of today's nuclear power plant emergency core cooling systems (ECCS) and the criteria governing them; describes the efforts of AEC Chairman Schlesinger to determine the true facts and suggests that he advocate a nuclear power moratorium until the reliability of the ECCS has been fully assessed.

2246. **Gillette, R., "Nuclear Reactor Safety: At the AEC the Way of the Dissenter is Hard"**, *Science*, **v. 176, no. 4034, 5 May 1972, pp. 492-498.**

Discusses concerns over the reliability of the emergency core cooling system and the AEC's tendency to reject or discourage dissenting views existing within the Commission itself; describes questions as to the adequacy of interim criteria established for the ECCS, including new operating rules to reduce the chance of a loss-of-coolant accident and special instructions for evaluating performance of ECCS in the event of a major leak; notes the lack of communication between the nuclear safety program and the AEC's regulatory arm, and suggests investigation of the status of reactor safety research and of the use of expert opinion by the AEC.

2247. **Hosmer, C., "Perspective on Nuclear Safety"**, *Congressional Record*, **v. 118, no. 50, 30 March 1972, pp. E3371-3372.**

Suggests that the complex technical problem of nuclear power plant safety be left to the judgment of competent, objective scientists rather than be analyzed in the pages of the *Congressional Record* by people who know little about it; notes the lack of public attention being given to other activities (e.g., construction and operation of oil and gas pipelines) which could be quite hazardous if certain events occurred, and the scarcity of studies showing the damage to public health and safety that would result from power shortages; reprints a letter by Dr. H. A.

Bethe, Nobel Prize winning nuclear physicist, listing 10 reasons for his opposition to a moritorium on nuclear plant construction.

2248. *Liquid Metal Fast Breeder Reactor Demonstration Plant – Environmental Statement*, **U.S. Atomic Energy Commission, April 1972, 411 pp.** (Available from U.S. Atomic Energy Commission, Washington, D.C. 20545.)

Describes the design of the proposed LMFBR demonstration plant, the alternatives to its construction, and the safety and environmental review procedures; discusses general environmental impacts of two types – those incidental to plant operation and those that may arise if an accident occurs; compares environmental implications of 1000 MWe nuclear and fossil-fueled power plants.

2249. **Tiernan, R. O., "Nuclear Fusion",** *Congressional Record*, **v. 118, no. 106, pp. E6570-6571.**

Expresses concern that R&D on alternative methods of atomic power generation to the liquid-metal cooled fast breeder reactor, primarily nuclear fusion, are being significantly underfunded; presents an article by R. C. Cowen which discusses the fusion process, needed appropriations and priorities, and needed R&D to place a prototype fusion power plant in operation around 1990.

2250. **Butler, M. L., "AEC Issues Guide for Preparation of Benefit-Cost Analysis for Nuclear Power Plants",** *AEC News Releases*, **v. 3, no. 20, 17 February 1972, p. 3.**

Announces the issuance of the AEC's "Guide for Submission of Information on Costs and Benefits of Environmentally Related Designs for Defined Classes of Completed and Partially Completed Nuclear Facilities", as required by AEC regulations implementing the National Environment Policy Act of 1969. (Available from The Director of Regulatory Standards, U.S. Atomic Energy Commission, Washington, D.C. 20545.)

2251. **Muntzing, L. M., "The AEC Reactor Licensing Program",** *AEC News Releases*, **v. 3, no. 21, 24 May 1972, pp. 8-11.**

Describes the present status of nuclear reactor licensing, and discusses the critical review process which is conducted at the construction-permit stage to resolve the safety, health, and environmental issues pertaining to that plant's construction and use; outlines the manpower and organizational changes in the licensing process resulting from the *Calvert Cliffs* court decision; describes the role public hearings are playing in present licensing procedures.

2252. **Ramey, J. T., "Delays in Nuclear Plant Licensing: Causes and Possible Solutions",** *Congressional Record*, **v. 118, no. 77, Part II, 11 May 1972, pp. E5146-5149.**

AEC Commissioner Ramey discusses the significant reasons why the U.S. is not now striking the proper environment – energy balance in the licensing and regulation of power plants – and, in particular, nuclear plants – and how this is resulting in delays in meeting energy demands; points to the need for eliminating asymmetrical, overlapping, and duplicative review and approval processes that foster delaying tactics by small groups of activists; calls for long-range planning with public participation, early public notice, hearings on all proposed power plant sites, and expanded R&D.

2253. **Manning, M. L., "Nuclear Standards – Licensing, Government and Industry",** *AEC News Releases*, **v. 3, no. 20, 17 May 1972, pp. 4-6.**

Discusses the urgent need for improvement in development of standards both in industry and the AEC, and describes the problems in licensing created by lack of such standards, citing as an example the multiplicity of designs of water-cooled reactors; offers suggestions for organization of industry and AEC standards work, pointing out that the AEC's R&D program provides a sound basis for standards.

2254. **Ingram, F. L., "AEC Policy Statement Emphasizes Standard Design of Nuclear Power Plants",** *AEC News Releases*, **v. 3, no. 18, 3 May 1972, p. 4.**

Discusses the importance of standardization, which would lead to higher operating reliability, greater ease of maintenance, and greater efficiency in the AEC's regulatory decision-making process; describes the benefits that would accrue to the national energy program and to the public: greater protection of public health and safety, and of the environment; improved plant reliability, availability, and overall economy; concentration of safety-related R&D in fewer areas; more efficient use

of resources available for conduct of safety and environmental reviews of new plant designs.

2255. *Atomic Energy Legislation Through 92d Congress, 1st Session,* **Joint Committee on Atomic Energy, Congress of the United States, January 1972, 394 pp.** (Available from Document Clerk, Joint Committee on Atomic Energy, Room H-403, U.S. Capitol, Washington, D.C. 20510.)

Presents a collection of statutes pertaining to atomic energy; includes 25 appendixes presenting indexes to legislative history of Atomic Energy Acts of 1954 and 1946, appropriations for the Atomic Energy Program, specific agreements and treaties, and specific studies and projects.

2256. *Forecast of Growth of Nuclear Power,* **Division of Operations Analysis and Forecasting, U.S. Atomic Energy Commission, Report WASH-1139 (Rev. 1), January 1971, 187 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.50.)

Presents projections of U.S. and foreign nuclear-power growth to 1985, which were derived by extrapolating data on nuclear and conventional power plants installed after 1959 and those currently being constructed or definitely planned for future construction in Free World countries; gives estimates of requirements for nuclear fuel based on data and assumptions about the design and operating characteristics of nuclear power plants.

2257. **Hosmer, C., "A New Look at Nuclear Science",** *Congressional Record,* **v. 118, no. 69, 1 May 1972, pp. E4517-4519.**

Describes the seriousness of the energy shortage in the U.S. and the implications for the future, with demands being expected to double between now and 1985; offers suggestions for a unified approach by government to our energy problem: endorsing the establishment of a National Energy Council patterned after the National Security Council, and recommending the elevation of the AEC National Laboratories to the status of U.S. National Laboratories; examines all aspects of nuclear power generation, and describes the urgent need for reform in reactor licensing procedures.

ENERGY – UNCONVENTIONAL SOURCES

2258. **Kenward, M., "Fusion Power Politics in the U.S.",** *New Scientist,* **v. 54, no. 796, 18 May 1972, pp. 380-382.**

Describes developments in plasma containment which are forcing a reevaluation of funding levels for the fusion research program, with scientists feeling that increased funding is essential to the "orderly development of a scientific feasibility demonstration"; observes that development of new technologies are critical for a fusion-reactor program, since without these developments American science may find itself in the position of having demonstrated feasibility, but without the necessary knowledge to proceed.

2259. **Gravel, M., "Energy Priorities in the Federal Budget",** *Congressional Record,* **v. 118, no. 106, 28 June 1972, pp. E6513-6514.**

Sen. Gravel criticizes the Administration for practically neglecting, in its energy budget, those energy sources, such as geothermal energy, solar power, hydrogen, fuel cells, coal gasification, and mine reclamation, which will be most important in the future; tabulates Federal energy R&D funding by year, agency, and subject area (coal resources development, petroleum and natural gas, nuclear fission, nuclear fusion, environmental impact, and general energy R&D), with fission receiving the lion's share ($356 million) of the $622 million total for FY 1973.

2260. *Solar Energy in Developing Countries: Perspectives and Prospects,* **Report of an Ad Hoc Advisory Panel of the Board on Science and Technology for International Development, Office of the Foreign Secretary, National Academy of Sciences, March 1972, 49 pp.** (Available from Office of the Foreign Secretary, National Academy of Sciences, 2101 Constitution Ave., Washington, D.C. 20418.)

Emphasizes the need for detailed studies of the energy requirements in a given area as a basis for selecting the most useful energy processes to be developed; describes present solar process applications (solar evaporation, distillation, drying,

and water heating) and those in experimental stages (e.g., space heating, air conditioning, refrigeration, cooking, and conversion to mechanical or electrical energy).

2261. **Stonier, T., "An International Solar Energy Development Decade: A Proposal for Global Cooperation",** *Bulletin of the Atomic Scientists,* **v. 28, no. 5, May 1972, pp. 31-34.**

Describes the benefits accruing from the use of solar energy: cheap power, increased industrial productivity and food production, and reduction in environmental degradation; proposes creation of an international solar-energy-development program under the auspices of the U.N., directed toward expansion of existing technologies to provide large sources of solar energy to all countries; envisions that global cooperation in an effort of this magnitude would be a major factor in reducing international tensions and would lead to world peace.

2262. **Zwach, J. M., "Shades of Our Grandfathers",** *Congressional Record,* **v. 118, no. 57, 12 April 1972, p. E3616.**

Reprints an article which emphasizes the need for a nonpolluting method of generating power, and suggests two energy sources – large scale wind power and ocean thermal gradient machines – pointing out their potential and advantages.

ENVIRONMENT – BIBLIOGRAPHY

2263. *The Environment Index 71: A Guide to the Key Environmental Literature of the Year,* **Environment Information Center, Inc., March 1972, 582 pp.** (Available from Environment Information Center, Inc., 124 East 39th St., New York, N.Y. 10016. Price: $75.00.)

Presents a comprehensive listing of worldwide literature on the environment, including articles, government documents, research reports, conference proceedings, books, patents, and films, while omitting brief articles, those with limited shelf life, or those whose contribution was marginal; includes keyword list, subject and author indexes.

ENVIRONMENT – INTERNATIONAL COOPERATION

2264. *International Cooperation in the Human Environment Through the United Nations,* **Hearings before the Subcommittee on International Organizations and Movements of the Committee on Foreign Affairs, U.S. House of Representatives, 92nd Congress, 2nd Session, 15-16 March 1972, 101 pp.** (Available from the Committee on Foreign Affairs, U.S. House of Representatives, Washington, D.C. 20515.)

Presents text and comments on bill H.R. 13116 to promote international cooperation in United Nation's efforts to protect the world's oceans and atmosphere and U.S. participation in the U.N. Conference on the Human Environment; includes a paper entitled "The Human Environment: Science and International Decision-Making". [*SPR* 4(4):1586.]

2265. **"U.S.-U.S.S.R. Environmental Protection Agreement",** *Weekly Compilation of Presidential Documents,* **v. 8, no. 23, 5 June 1972, pp. 909-991.**

Comprises 7 articles calling for joint research development, mutual cooperation, and exchange of information in all 11 specific areas of environmental protection: air and water pollution; pollution associated with agricultural production; enhancement of urban environment; preservation of nature and organization of national parks; biological and genetic consequences of pollution; influence of environmental changes on climate; earthquake prediction; arctic and subarctic ecological systems; and legal and administrative measures for protecting environmental quality.

2266. **Serwer, D.,** *International Cooperation for Pollution Control,* **UNITAR Research Report No. 9, April 1972, 73 pp.** (Available from Publications Unit, UNITAR, 801 U.N. Plaza, New York, N.Y. 10017, Price: $2.50.)

Deals with means of controlling pollution, including protection, discharge, and technological standards, complete prohibitions, and effluent charges and price adjustments, as well as means of promoting compliance with these; aims are to show the range of means available, indicate basic issues in the choice of means,

suggest how they may be used to solve problems of international interest, and consider the organizational implications of taking action along these lines.

2267. **McLin, J., "Stepping Across Boundaries"**, *Environment*, **v. 14, no. 4, May 1972, pp. 16-28.**

Reviews and evaluates the environment-related activities of the major European organizations: The Economic Commission for Europe (ECE), which includes both East and West European countries; the Council of Europe which has been active with its European Committee for the Conservation of Nature and Natural Resources; NATO which has a good record in the international transfer and application of technology; the Organization for Economic Co-operation and Development; and The European Economic Community (Common Market); biggest criticism concerns the duplication of effort, and the conduct of studies as an excuse for inaction, when political or financial difficulties prevail.

2268. **"Environment: A New Programme of International Co-operation"**, *OECD Observer*, **no. 58, June 1972, p. 27.**

Describes plans of the World Meteorological Organisation (WMO) to set up a worldwide network for measuring general background air pollution and studying how it may possibly effect long-term changes in global climates; and of the 10-country Air Management Sector Group of OECD's Environment Committee to assess, in a 4-stage program, the relative importance of local and distant sources of sulphur compounds in terms of their contribution to the air pollution over a region, and also tostudy pollutant transport mechanisms.

2269. **Nobbs, C., "The Problem of Chemicals in the Environment"**, *OECD Observer*, **no. 57, April 1972, pp. 33-35.**

Examines the issues raised in the discussions of environmental monitoring at the Berlin conference on "The Occurrence and Significance of Chemicals in the Environment", describing the chief concerns: assessing the results of the international cooperative effort on measuring toxic chemicals in wildlife and establishing the relationship between exposure of a species and the biological effects; discusses the problems of implementing proposals for global monitoring of chemicals, and suggests a possible alternative – establishment of the environmental acceptability of chemicals in the laboratory prior to their discharge.

ENVIRONMENT – MAN INTERACTION

2270. *Environmental Resources Conference*, **Press Release from Battelle's Columbus Laboratories, 31 May 1972, 2 pp.** (Available from Battelle, Publications Department, Columbus, Ohio 43201.)

Announces a 3-day environmental resources conference to be held October 31-November 2 in Columbus, Ohio, sponsored jointly by the U.S. Environmental Protection Agency, the National Science Foundation, and the Columbus Laboratories of Battelle; environmental specialists from government, industry, and universities will discuss such topics as: natural, industrial, and municipal sources of metals; control processes used in transportation, industry, and mining; monitoring for air, water, and solid waste pollution; and economics of recovery and reclamation. For further information contact G. R. Smithson, Jr. (program), or D. A. Yothers (arrangements) at Battelle-Columbus, 505 King Avenue, Columbus, Ohio 43201 (telephone 614-299-3151).

2271. *Water, Man, and Nature: A Symposium Concerning the Ecological Impact of Water Resource Development*, **Sponsored by the Department of the Interior, Bureau of Reclamation, and American Institute of Biological Sciences, held August 30-31, 1971, at Colorado State University, Fort Collins, Colo., 1972, 27 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 50 cents.)

Presents papers delivered at the Symposium which discuss the engineering, ecological, agricultural, and waste aspects of the man, water, nature interaction; summarizes the 8 workshops, each dealing with a specific ecological impact; and lists the principal conclusions, highlighting the need for expanded research in all areas, for expanded data collection to establish ecological baselines from which to assess resource-development impacts, for involvement of ecologists in water

resource planning at the outset, and for developing a better informed public.

2272. **Ruckelshaus, W. D.,** *The New World of Environmental Values,* **Presented to the American Camping Association, 10 March 1972, New York, N.Y., 9 pp.** (Reprints available from Office of Public Affairs, Environmental Protection Agency, Washington, D.C. 20460.)

Discusses the important work done by the ACA to protect the environment and to teach the young environmental awareness; describes the Environmental Merit Awards Program, which recognizes constructive environmental achievements of high school students and high school age people enrolled in summer camps; discusses land use for campgrounds and parks.

2273. **Ruckelshaus, W. D., "The Coming Synthesis of Urbanism and Environmentalism", Paper presented at North Carolina State University, 13 May 1972, 10 pp.**

The administrator of the Environmental Protection Agency discusses the relationships between society and the environment; emphasizes that the foremost task is to look upon the city as a totality, instead of focusing on specific subproblems, and that the solutions to the bigger urban problems "require breaks from traditional values, the application of sociodynamics and behavioral engineering in our daily lives, and a willingness to forego short-run personal gains for the sake of broad improvements in the community as a whole".

2274. **"Remarks by the Honorable Russell E. Train",** *Congressional Record,* **v. 118, no. 52, 5 April 1972, pp. S5419-5421. (Speech before the Los Angeles World Affairs Council.)**

Discusses increased concern for the environment as evidenced by international actions prior to the Stockholm Conference; describes major areas whereon research should be focused: population size and distribution, the carrying capacity of the earth, resource use and the ability of the market to allocate future resources, the potential of technology to expand at the same rate as population along with the possible consequences, and future distribution of income.

2275. **Brubaker, S.,** *To Live on Earth: Man and His Environment in Perspective,* **A Resources for the Future Study, Johns Hopkins Press, Baltimore, Md., and London, England, 1972, 202 pp.** ($6.95)

Analyzes the economic and demographic trends underlying the many threats to environmental quality, focusing particularly on U.S. problems; classifies the threats according to their nature and gravity, and examines 5 major hazards (man's effect on the global climate, radioactivity, pesticides, fertilizers, erosion); considers the many other kinds and degrees of hazards in terms of their present or potential effects on the receiving media (principally water and air), and examines the possible contributions of technology along with the economics of dealing with environmental problems.

2276. **Maddox, J.,** *The Doomsday Syndrome,* **Macmillan, New York, N. Y., 1972, 248 pp.** (£2.95)

Presents a critical evaluation of the environmental case, exposing the scanty evidence and the perverted logic which have been used by environmentalists as the basis of predictions of ecological doom: e.g., "the death of plankton causing global deoxygenation, man's poisoning from mercury-laden tuna fish, and his shriveling up through sunburn and skin cancer when Concorde peels off the stratospheric ozone layer"; emphasizes that the environmentalists have exaggerated and simplified so extensively that they may accomplish the opposite of what they desire.

2277. *Mass Media and the Environment, Vol. I – San Francisco and Monterey Bay Water Resources; Vol. II – The Environmental Information Explosion: The Free Press Discovers the Environment; Vol. III – A Guide to Information Sources in the San Francisco Bay Area,* **Stanford University, September 1971, Vol. I, 260 pp; Vol. II, 304 pp; Vol. III, 66 pp.** (Available at nominal cost from Environmental Research Project, Department of Genetics – IRL, Stanford University School of Medicine, Stanford, Calif. 94305.)

Vol. I presents an overview of ecological medicine and examines water development and resources, the problem of resource allocation, waste water treatment, and utilities' secrecy on nuclear power plant siting plans; Vol. II describes environmental problems, the dimensions of the environment-information explosion in the news media, the obstacles facing the press in reporting environmental deteriora-

tion, and the difficulties of gaining access to plans of public utilities; Vol. 3, a directory, serves as a concise guide to specific environmental information sources.

ENVIRONMENT – NATURAL HAZARDS

2278. *Earthquake Legislation*, **Press Release from the office of Senator Ernest F. Hollings, May 10, 1972, 1 p.**

Announces the introduction of earthquake legislation by Sen. Hollings, Chairman of the Senate Subcommittee on Oceans and Atmosphere, which would provide for a comprehensive national program of earthquake prediction and protection; under this bill the National Oceanic and Atmospheric Association would establish a national surveillance program to monitor the occurrence of earthquakes, and a national earthquake warning system would be created.

2279. **"NOAA's National Earthquake Information Center Moves West, Improves U.S. Coverage"**, *U.S. Department of Commerce News*, **Release NOAA 72-80, 11 June 1972, 3 pp.**

Announces the relocation of the Earthquake Information Center at Boulder, Colorado, in order to tap a much improved source of earthquake data for the highly seismic western U.S.; the Center, which is to be almost entirely automated, will receive seismic signals over telemetry links from stations in California, Utah, and Colorado, including one in Boulder, and will eventually have the capability to locate any destructive earthquake in the U.S. within 1/2 to 1 hour.

ENVIRONMENT – U.N. CONFERENCE

2280. **Muskie, E. S., "Stockholm Conference on the Human Environment"**, *Congressional Record*, **v. 118, no. 85, 25 May 1972, pp. S8445-8448.**

Discusses the vast potential of the Stockholm Conference, and criticizes the Administration's imposition of predetermined positions on the U.S. delegates which are not representative of those held by Congress, for example, with respect to (1) the establishment of guidelines for control of land-base pollution and (2) the provision of funds to developing countries for combatting pollution; reprints the text of the "Scope Paper", a summary of major U.S. environmental positions.

2281. **Gude, G., "The United Nations Conference on the Human Environment in Stockholm, Sweden"**, *Congressional Record*, **v. 118, no. 105, 27 June 1972, pp. E6482-6485.**

Rep. Gude discusses successful efforts by the Conservation and Natural Resources Subcommittee of the House Committee on Government Operations to persuade the Departments of State, Transportation, and Justice to agree on having the Coast Guard enforce U.S. oil pollution laws between the 3- and 12-mile limits around the U.S. seacoasts; describes the important role played by the U.S. at the Stockholm Conference; discusses the Environmental Protection Agency's plans to ban almost all uses of DDT; presents a speech by R.K.A. Gardiner discussing the posture and thinking of the underdeveloped nations in reference to environmental problems.

2282. **Hawkes, N., "Stockholm: Politicking, Confusion, but Some Agreements Reached"**, *Science*, **v. 176, no. 4041, 23 June 1972, pp. 1308-1310.**

Outlines the major positive achievements of the Stockholm environment conference: passage of resolutions to establish an international convention on marine dumping, to set up a global monitoring system, and to establish a new environmental organization (a Governing Council for Environmental Programmes); less significant resolutions included recommendations for the provision of more technical assistance to developing countries on environmental programs, for setting up a referral system for environmental information, and a study of river pollution.

2283. **"Science at Stockholm: A Worldwide Earthwatch"**, *Science News*, **v. 101, no. 25, 17 June 1972, p. 390.**

Reviews 6 discussions at the U.N. Conference on he Human Environment, including Earthwatch, a proposed worldwide environmental monitoring system which was given overwhelming approval at the Conference, the only disagreement coming over funding; describes some features of the system, which includes more than 100

stations for monitoring regional air quality; describes discussions on continued economic development and the future of the earth's environment; reports that no agreement on proscription of ocean dumping appeared.

ENVIRONMENTAL AGENCIES

2284. **"EPA to Charge Tuition for Courses after July 1"**, *Environmental News*, **22 June 1972, 3 pp.**

Reports plans of the Environmental Protection Agency to charge tuition for its technical and managerial training courses, beginning in FY 1973; increased program grants to states for pollution control should enable them to enroll their trainees in the EPA courses; fees per student day range from $40 for the pesticides course to $100 for the water quality course; about 8000 enrollees in the 334 courses are expected, approximately half being from state and local agencies.

2285. **"EPA Names First Director of Education and Manpower Training"**, *Environmental News*, **8 June 1972, 1 p.**

Announces the creation of a new EPA post, in which George L. B. Pratt, former president of Arkansas Polytechnic College, will be responsible not only for unifying and expanding the Environmental Protection Agency's intraagency programs in manpower development, training, and environmental education, but also for coordinating EPA's efforts in those areas with other governmental and private organizations; outlines Dr. Pratt's education and professional experience.

2286. **Dingell, J. D., "Environmental Impact Statements"**, *Congressional Record*, **v. 188, no. 58, 13 April 1972, pp. E3778-3780.**

Presents the text of the Council on Environmental Quality's April 1972 issue of the *102 Monitor*, including remarks by R. E. Train, Chairman, concerning questions on the environment and national priorities, and emphasizing the need for a national debate on growth; includes a listing of environmental impact statements received by the CEQ during March.

2287. **"Council on Environmental Quality Issues Supplemental Guidance to Agencies for Improving Agency NEPA Procedures"**, *Congressional Record*, **v. 118, no. 105, 27 June 1972, pp. E6489-6501.**

Consists of the entire text of the May 1972 issue of the CEQ's *102 Monitor* [see *SPR* 4(2):526 and 5271], presenting 10 recommendations for improving agency NEPA procedures, and listing draft and final environmental impact statements received from each agency.

ENVIRONMENTAL LEGISLATION

2288. **Cohn, V., "Cutting the Legs Off Section 102"**, *Technology Review*, **v. 74, no. 6, May 1972, pp. 7-8.**

Describes the results of Section 102 of the EPA Act of 1970 requiring environmental impact statements on major projects: court actions blocking or delaying projects such as nuclear power plants, the Cross-Florida Barge Canal, federal sale of oil and gas leases, and the Trans-Alaska Pipeline; notes pressures for exemptions from or amendments to this requirement and describes opposing concerns – over delay in progress in the name of environmental protection and over the consequences of weakening the EPA Act.

2289. **Gillette, R., "National Environmental Policy Act: Signs of Backlash are Evident"**, *Science*, **v. 176, no. 4030, 7 April 1972, pp. 30-33.**

Notes the discontent toward NEPA stemming from the burden of paper work imposed by the requirement for preparing environmental impact statements for major governmental actions; describes federal agencies' pressures for new legislation to grant some exceptions to that requirement and to permit interim licensing of nuclear plants.

2290. **"Power and Pollution: Fuel for a Backlash"**, *Nature*, **v. 236, no. 5348, 28 April 1972, pp. 422-423.**

Describes the concerns of environmentalists over two governmental actions: (1)

passage of a bill by the House of Representatives which allows the Atomic Energy Commission to issue temporary operating permits for some power plants without subjecting them to full environmental review; and (2) the Supreme Court's ruling that environmentalist groups cannot go to court to block projects affecting the environment unless the interests of their members are directly affected; suggests that the greatest setback for the environmental movement could arise from loss of public support brought about by power shortages expected during the summer months.

2291. **La Follette, D., "Citizens Must Act Now to Help Save an Important Environmental Tool"**, *Congressional Record*, **v. 118, no. 91, 6 June 1972, pp.S8827-8828.** (Reprinted from May 29 *Milwaukee Journal.*)

Calls for public support of the National Environmental Policy Act which has been the key to prevention of many programs that would have been detrimental to the environment; expresses concern over attempts to undermine the law and its effectiveness through the introduction of amendments and new legislation (e.g., to allow water pollution permits to be issued without fulfilling NEPA's requirements, to allow licensing of nuclear plants without environmental impact statements, and to relieve the Department of Transportation of its responsibility for environmental impact from highway projects).

2292. **Gillette, R., "National Environmental Policy Act: How Well is It Working?"**, *Science*, **v. 176, no. 4031, 14 April 1972, pp. 146-150.**

Describes the effectiveness of NEPA's requirement for environmental impact statements, particularly in forcing government agencies to reveal the reasoning behind their activities, and to solicit and respond to comments from the public and other agency's before taking any major action; discusses NEPA's drawbacks, its apparently minimal effect so far on agency decisions, and the possibility that agencies will shape impact statements to fit preconceived decisions.

ENVIRONMENTAL RESEARCH

2293. *Environmental Research: A Status Report*, **Committee for Air and Water Conservation and Committee on Public Affairs, American Petroleum Institute, January 1972, 141** pp. (Available from Committee for Air and Water Conservation, American Petroleum Institute, 1801 K Street, N.W., Washington, D.C. 20006.)

Briefly reviews API's past efforts in the pollution-control area, summarizes the status of projects currently being conducted under direction of the various committees, and presents abstracts of completed projects; the projects cover a wide range of subjects including effects of air pollution on plants and humans, and prevention and control of oil spills.

2294. **"AEC Designates Nation's First Environmental Research Park"**, *AEC News Releases*, **v. 3, no. 25, 21 June 1972, pp. 1-2.**

Reports the Atomic Energy Commission's designation of nearly 200,000 acres of land in South Carolina as the U.S.'s first Environmental Research Park, which opens the site to scientists from other Government agencies, universities, nd private foundations for use as a protected outdoor laboratory where long-term projects can be set up to answer questions about man's impact on the natural environment.

EUROPE

2295. **"European Economic Community: Science, Technology and Industry in the EEC"**, *Nature*, **v. 237, no. 5352, 26 May 1972, pp. 202-205.**

Reviews actions toward European cooperation in science and technology over the past 25 years, and attributes the slow progress to the lack of any treaty authority for the EEC to effect the industrial reorganizations and regrouping needed to take best advantage of R&D cooperation in such fields as computers and aerospace; describes the 19-nation COST group's failure to develop a large European computer, its successes in joint ventures in data handling, telecommunications, metallurgy, and environmental matters, and future projects on weather forecasting, passenger transport, and medical research; outlines the R&D activities of the

Commission of the European Communities and points to its successful Community-financed biology and fusion programs done under contract by Member-State centers; describes plans to create a European Committee on R&D (CERD) to establish priorities and recommend procedures and a European Science Foundation for basic research.

2296. **"Survey of Science in Europe: Prospects for European Collaboration"**, *Nature*, **v. 237, no. 5352, 26 May 1972, p. 201.**

Points out that in the past year there has been some progress toward international cooperation among European scientists and engineers, and that the European Commission in Brussels is increasingly effective in this regard; deplores the waste resulting from independent research on the same things (e.g. nuclear reactors or telecommunications equipment) by different European governments; recommends that European governments purchase advanced equipment on the basis of price, and not insist on buying from their own industries, and that they pool their resources to conduct basic research through universities and other institutions throughout Europe.

2297. **"European Technology"**, *Nature*, **v. 236, no. 5347, 21 April 1972, p. 362.**

Contends that the conference held in Venice in April by the Commission of the European Communities did little to further technological development in Europe, since too much time was planned for long-term problems that are essentially political in character (e.g., regional development policy, a European patent system, and removal of trade barriers); suggests tha. more attention should be paid to removing needless and wasteful competition among European nations in such areas as fast reactor development, aircraft production, and computer development.

2298. **"Foundation Far Ahead"**, *Nature*, **v. 237, no. 5355, 16 June 1972, p. 362.**

Reviews a talk by H. van Molthe, a member of the European Economic Commission, presented at a conference on industrial innovation (London, June 1972); Molthe discussed the lack of an innovation policy in Europe, noting that the present EEC agreement contains no reference to R&D, and outlined possible actions to rectify this: (1) establishment of a European Science Foundation; (2) award of EEC research contracts in materials science and environmental pollution; (3) advancement by the EEC of half the funds needed for medium size innovation projects by small companies; and (4) formation of a venture capital club combined with the European Investment Bank to underwrite high-risk projects.

2299. **"$5,000m for EEC Research in 1971"**, *Science Policy*, **v. 1, no. 2, March/April 1972, p. 3.5.**

Presents figures on R&D expenditures in EEC countries, which reveal a rapid rise in civil appropriations with diminished expenditures for military R&D, an increase in public R&D spending reflecting greater involvement by private industry, an increase in the proportion of funds intended for improvement of the environment (reaching almost 10%), and a decrease in the relative value of contributions to bilateral or multilateral projects.

2300. **Segal, G., "Eastern Europe Looks to the Computer"**, *New Scientist*, **v. 54, no. 798, 1 June 1972, pp. 506-509.**

Discusses the present state of computerization in Eastern Europe, which has only recently recognized the value of computers in reating a centralized planning system to boost economic growth; briefly describes the East European countries' methods of utilizing computer systems; with some following current Soviet models (computerizing industrial sectors, then working them into a statewide network), while others use computers "as part of a statewide system".

2301. **Owen, D., "A Nuclear Strategy for Europe"**, *New Scientist*, **v. 54, no. 798, 1 June 1972, pp. 503-505.**

Discusses the current defense budgets and nuclear capabilities of Western European nations, noting that lower defense budgets preclude the possibility of an independent nuclear force; presents the pros and cons of collaboration, pointing out that because British and French deterrent systems will be obsolete in less than a decade, concrete decisions must soon be made; describes the dependence of all options on American Technology, and suggests that the U.S. might be able to exert an influence on the development of the guidelines for the use of all Allied nuclear weapons.

2302. **"Energy Policy in the European Community"**, *OECD Observer*, **no. 58, June 1972, pp. 36-39.**

Sums up the present energy situation and prospects for the 6 countries of the European Community combined, based on a paper specially prepared by the Commission on the EEC's energy policy for confrontation in the OECD Energy Committee at which Japan and Sweden were examiners; restates the principles and objectives guiding the Commission's action, and describes the past achievements and future plans; stresses the importance of a Community market covering all Member States and operating under uniform regulations, in order to achieve a joint energy policy.

2303. **Shepherd, L. R., "European Cooperation on High Temperature Reactors"**, *Nature*, **v. 237, no. 5352, 26 May 1972, pp. 215-216.**

Reports on the progress of High Temperature Reactor Project, a joint U.K.-European project initiated in 1959; describes its organization and management, and assesses its achievements, noting in particular that it provided the world's first high-temperature reactor.

FACILITIES FOR R&D

2304. **Smith, P., "MSFC's Last RIF Forecast by Dr. Rees"**, *Congressional Record*, **v. 118, no. 98, 16 June 1972, pp. S9549-9550.**

Describes the future of research at Marshall Space Flight Center which will end an important part of its history with the final flight to the moon of the Apollo program; plans for MSFC include a possible lead role in communications projects; participation in projects related to human needs, in the Skylab project, and in the space program; and the development of the LST (largest space telescope).

FORECASTING

2305. **Markham, Sister M. C., and Enzer, S., "Shaping the Future"**, *Chemical Technology*, **May 1972, pp. 262-268.**

Reports the overall results of a Conference sponsored by the Connecticut Valley Section of the American Chemical Society to "explore the potential of scientific/technical societies and research groups in promoting public understanding of decision-making in an advanced technological society"; identifies three eras of technological development involving partnership with science: (1) science and industry (until about 1930); (2) science and politics (pre- and post-Sputnik); and (3) science and societal goals (today); describes the audience participation techniques used to compile a list of key events that might occur in the next 10 years which the participants thought would have the greatest impact on people's goals, and audience evaluation of these events.

2306. **Arnfield, R. V., "Who Shall Plan the Future?"**, *New Scientist*, **v. 54, no. 790, 6 April 1972, p. 34.**

Reviews a book by E. Jantsch *(Technological Planning and Social Futures)* which contains a series of articles covering 6 basic themes, including: (1) a general framework for long-range thinking, its application to the development of technology, and its translation in terms of corporate planning; (2) the principal categories and methodological concepts of technological forecasting; (3) the basic shift from production- to function-oriented thinking brought about by corporate strategic long-range planning; and (4) the merging roles of corporate responsibilities to mankind.

2307. **Coenen, R., "The Use of Technological Forecasts in Government Planning"**, *Research Policy*, **v. 1, no. 2, April 1972, pp. 156-172.**

Outlines the technological forecasting techniques (extrapolations, analogies, simulation models, and expert surveys), their limitations, and the problems of application; reveals the interdependence of planning and forecasting, and distinguishes between "normative" and "exploratory" forecasting.

2308. **Taviss, I.,** *Futurology and the Problem of Values*, **Harvard University Program on Technology and Society, Reprint No. 12 (from** *International Social Science Journal*, **v. 21, no. 4, 1969, pp. 574-584), 1972, 12 pp.**

Discusses the need for reevaluations and redefinitions of values as changes occur in the social structure, since the associated changes in values can affect the accuracy of predictions (citing as an example how a possible deemphasis on economic growth could make predictions in this area for the year 2000 appear entirely out of focus); examines the possible influence of predictions in shaping the future, by indirectly bringing about changes in human behavior and attitudes.

FOREIGN AFFAIRS

2309. **"New Agreement with Soviet Academy Expands Bilateral Exchange Program by 20 Percent"**, *NAS/NRC/NAE News Report*, **v. 22, no. 4, April 1972, p. 1.**

Reports new agreement providing for 216 man-months of visits by Soviet scientists to the U.S. and vice versa during 1971-72 – an increase of 15% over the exchange-visit duration called for in the previous agreement; the agreement also provides for joint research not subject to the man-months limitation.

2310. **"Report on U.S. Foreign Policy in 1971: Sections on Science"**, *International Science Notes*, **no. 27, May 1972, pp. 12-16.**

Describes U.S. efforts directed toward international cooperation in the fields of peaceful uses of atomic energy, space, and atmospheric sciences; U.S. bilateral scientific and technological programs with France, Spain, the U.S.S.R., Poland, Brazil, and Japan; and U.S. participation in multilateral activities in cooperation with OECD, ECE, NATO's Science Committee, and OAS; significant developments include: approval of an international nuclear safeguards system, experimental earth resources satellites, Soviet cooperation in space activities, establishment of a Global Atmospheric Research Program, and establishment of cooperative programs in such areas as oceanography, environmental pollution, transportation, and medical science.

FRANCE

2311. **"French Atomic Energy Budget for 1972"**, *Science Policy*, **v. 1, no. 2, March/April 1972, p. 3.2.**

Examines the CEA's budget for 1972, which shows a slight increase in the total funding, a decrease (1%) in the civil sector, and an increase (~4%) in the defense sector; notes the reduction in CEA's own resources (almost 50%) due mainly to the halt in building new power stations between 1967 and 1970; describes the constraints affecting expenditure, and outlines the CEA's basic options.

2312. **"French Science Policy in 1972"**, *International Science Notes*, **no. 27, May 1972, pp. 2-3.**

Presents highlights of France's 1972 budget for R&D: allotment of almost $300 million for civilian atomic energy research; $30 million for agricultural, medical, and oceanographic research oriented strongly toward applications and coordination with private industry; and $144 million for space programs, which represents a decrease of about 3/8%; notes the emphasis on science's role in economic and social progress, on industrial innovation, and on subcontracting by private industry to foster government-private industry interchange.

2313. **"France: Crucial Year for French Science Policy"**, *Nature*, **v. 237, no. 5352, 26 May 1972, p. 210.**

Calls attention to financial woes of the sixth French research plan (1971-1975), stemming largely from the fact that the bulk of the funds continues to be allocated to nuclear energy and space instead of falling off as expected; reviews problems faced by the Centre National de la Recherche Scientifique (CNRS) in attempting to develop research in the engineering sciences: controversy with engineering schools and with industry, and recruitment and training of scientists.

2314. **Walsh, J., "French Science Policy: Problems of 'Leveling Off' "**, *Science*, **v. 175, no. 4029, pp. 1446-1447.**

Discusses the leveling off of research funds and of the demand for scientific manpower in France, occasioned in part by the switchover from DeGaulle's policy of favoring strong national programs in defense, atomic energy, space, and com-

puters, to the present government's policy of seeking international cooperation in basic research and of cutting technological losses; points out that while U.S.-France cooperation in the areas of environmental and urban problems is good, such is not the case regarding satellites, noting in particular U.S. rejection of the FAA-ESRO plan for the Aerosat project.

GOVERNMENT-SCIENCE INTERACTION

2315. **Goran, M., "Technologists as Politicians"**, *Chemical Technology*, **March 1972, pp. 191-192.**

Presents a brief history, from the 13th century to present, of cases throughout the world where scientists served on governing bodies (as contrasted to working for a government); emphasizes how very few there have been (e.g., only two in the U.S. Congress in the last 10 years), in spite of the fact that technology is more and more of a public issue.

2316. **"The Pentagon and Basic Science"**, *Nature*, **v. 237, no. 5351, 19 May 1972, p. 124.**

Reviews the Department of Defense's past and present involvement with the support of basic scientific research in the U.S., and describes the detrimental effects that reductions in military expenditures for basic research will have on future development of science in the U.S.

2317. **Polanyi, J., "Basic Research: Its Goals and Its Organization"**, *Science Forum*, **v. 5, no. 2, April 1972, pp. 27-33.**

Emphasizes the importance of basic scientific research as the foundation for cultural, technological, and educational advances; discusses the organization of basic research with reference to policy decisions to be made by the government (total scale of effort and optimum distribution of that effort) and establishment of criteria for apportionment of funds; compares the levels of support for basic research by mission-oriented agencies in the U.S. and Canada; describes the "basic directions of science" in the U.S.S.R. and research planning in the U.K.

2318. **"Stever: Basic Research is Strongest Mission of NSF"**, *Physics Today*, **v. 25, no. 5, May 1972, p. 69.**

Presents comments made by H. G. Stever, Director of the National Science Foundation, which emphasize that the aim is to increase the amount of applied research; not to cut down on basic research; that the purpose of the Experimental R&D Incentives Program is to explore ways to increase industrial and other nonfederal investment in R&D; and that pressures exist for changing the direction of NSF education programs and institutional support.

2319. **"Federal Research for Long-Term Goals"**, *Environmental Science & Technology*, **v. 6, no. 6, June 1972, pp. 508-509.**

Outlines the research being conducted within the various divisions of the overall Research Applied to National Needs (RANN) program of the National Science Foundation, which deals with energy resources, systems, and technology; with environmental systems and resources, weather modifications, and trace contaminants; and with municipal systems and services; no in-house research is done by RANN – 75% of the research is conducted by universities, 10% by nonprofit organizations, 12% by national laboratories, and 3% by industry.

2320. **"Kennedy's Prescription for Civil Science"**, *Nature*, **v. 237, no. 5354, 9 June 1972, pp. 306-307.**

Examines the controversial provisions of Senator Kennedy's National Science Policy and Priorities Act, which, if passed, would eventually make the National Science Foundation the focal point of Federal science policy formulation; notes the NSF's opposition to the bill, stemming from NSF's reluctance to increase its responsibility for applied research; points out that the bill represents a fundamental realignment of policy by placing responsibility in a department of science and technology instead of in the present mission-oriented agencies; and suggests that debate on this issue alone should lead to a reevaluation of U.S. science policy.

2321. **"The White House and R&D: New Structures in the Offing?"**, *Science and Government Report*, **v. 2, no. 8, 15 June 1972, pp. 1-2, 4.**

Describes the Administration's increasing dissatisfaction with the existing structure

for linking the Executive Branch with R&D, and the growing recognition of the need for a change: two major lines of thought prevail concerning reorganization: (1) keep the present structure as it is, but staff it predominantly with industrial and business experience, and provide high-level backing for "management oversight" of interagency problems; (2) obliterate the present structure and create a Council of Technical Advisers (in the Executive Office or in the Commerce Department), wherein the emphasis would be on technology and industry, with science and education playing a supporting role.

2322. **Doty, P., "Can Investigations Improve Scientific Advice? The Case of the ABM",** *Minerva,* **v. 10, no. 2, April 1972, pp. 280-294.**

Examines the interplay of scientific advice and government decision making, and suggests means of improving the advisory process which will also increase the contact between congressmen and scientific and technical advisers; describes the fundamental limitations of the advisory process; the lack of operational data which forces reliance on assumptions as a substitute and the everlasting unresolvable differences in judgment.

2323. **Lewis, H. J., "The Science Adviser Uses Persuasion in the Hinterlands, While HSMHA Takes a More Direct Approach",** *sppsg Newsletter,* **v. 3, no. 4, April 1972, pp. 1-6.**

Describes efforts of E. E. David to alter the support pattern for academic research, to encourage a partnership in research between industry, academia, and local government, and to gain support for the Administration's R&D budget; presents details of the Health Services and Mental Health Administration plan for improving the Agency's capabilities to carry out its evaluation responsibilities through establishment of a University Center for Health Evaluation.

2324. **"New R&D Programs: Overexpectations",** *Astronautics & Aeronautics,* **v. 10, no. 5, May 1972, pp. 11-13.**

Describes the disappointment of the U.S. R&D community in the Technological Opportunities Program, which has proven relatively unproductive, and in President Nixon's message on technology which is merely a rehash of the FY 73 budget message; points out some encouraging aspects: the Administration's strong commitment to a positive policy regarding R&D, its recognition of the value of R&D to the economy and the nation, and its awareness of the need for a vigorous national R&D effort.

2325. **"A Friend in the Senate",** *Nature,* **v. 236, no. 5348, 28 April 1972, p. 424.**

Presents details of a bill introduced by Sen. Kennedy recommending an increased budget for the National Science Foundation in 1973 ($740 million): an increase of $52.6 million for NSF's education programs ($18 millio for institutional grants, $17.8 million for graduate student support, and $20.4 million for other science education improvement activities); and a $16.2 million increase for the RANN program ($12.6 million for energy research and $3.9 million for earthquake engineering).

2326. **"New Prizes to Honor Technology",** *Science,* **v. 176, no. 4040, 16 June 1972, p. 1217.**

Presents the eligibility requirements for the new Presidential Prizes for Innovation (to be awarded September 15, 1972) designed to honor individuals or teams who have been responsible for developing technological applications of demonstrable "utility and benefit to society" which have emerged in the last 10 or 15 years; the innovation must be in one or more of ten domestic areas, such as energy, natural resources, education, housing, transportation, and communications; a cash award of about $50,000 accompanies the prize; includes information on nomination submission.

2327. **Frankel, M. S.,** *The Public Health Service Guidelines Governing Research Involving Human Subjects: An Analysis of the Policy-Making Process,* **Program of Policy Studies in Science and Technology, The George Washington University, Report GWPS-Mon 10, February 1972, 63 pp.** (Available from National Technical Information Service, Springfield, Va. 22151. Price: $3.00.)

Examines (in Part I) the evolution of PHS Guidelines, tracing (1) evolution of thought and legal interpretation regarding research using human subjects; (2) initial involvement of the Federal Government; (3) development of the Government's research program; (4) the social-political environment in which formal government

policy was developed; and (5) various policy statements issued by the Government; Part II analyzes the process by which PHS Guidelines were developed and examines the values and other underlying factors which contributed to their development.

2328. **Broyhill, J. T., "Politics and Economics of the Environment"**, *Congressional Record*, **v. 118, no. 49, 29 March 1972, pp. H2888-2892.**

Reviews the efforts to deal with environmental problems, noting the singular lack of progress and describing the underlying reasons; discusses the actions needed to produce meaningful results: mount a concerted effort, determine the priorities, and learn the technology necessary to deal with specific problems; emphasizes that vast amounts of electric energy, along with systematic and purposeful direction of technology will be needed to clean up the environment.

2329. *National Science Foundation Annual Report 1971, 1972,* **107 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.50.)

Describes the activities and financial obligations of the Foundation for FY 1971 in the following areas: research support (funding for grants increased by $12.9 million over FY 1970), national and international programs, research applications [highlighting the establishment of the program of Research Applied to National Needs (RANN)], science education support, and institutional programs (grants totaling $14.5 million awarded to 659 institutions).

2330. **"Watchdog Audits Environmental Programs"**, *Environmental Science & Technology*, **v. 6, no. 5, May 1972, pp. 404-405.**

Describes the reorganization of the General Accounting Office (GAO) into seven divisions (with various subgroups) charged with determining whether individual programs are meeting the Congressionally mandated objectives of enacted legislation; discusses activities of the GAO in environmental areas, particularly those related to auditing of the Environmental Protection Agency's programs.

2331. **"All Change at the Top"**, *Nature*, **v. 237, no. 5356, 23 June 1972, p. 424.**

Discusses the personnel changes which will result from the defeat of 81-year-old G. P. Miller, Chairman of the House Committee on Science and Astronautics, in a primary election in California; O. E. Teague of Texas is in line for the chairmanship; points out that the Senate Committee on Aeronautical and Space Sciences is also in line for a new chairman, S. Symington being the likely successor to Committee Chairman C. P. Anderson.

2332. **Woodrow, R. J., "Government-University Financial Arrangements for Research"**, *Science*, **v. 176, no. 4037, 26 May 1972, pp. 885-889.**

Describes the importance of R&D in universities and colleges to the welfare of the U.S.; examines present government policies requiring these institutions to share the costs of government-sponsored research, pointing out the adverse consequences and the need for a change in financial arrangements for research; discusses the need for independent research, particularly in the humanities and social sciences, and for expansion of capital facilities to permit advancement of scientific and technological knowledge.

2333. *Bureau of Mines Grants for Research,* **January 1972, 16 pp.** (Available from U.S. Department of the Interior, Bureau of Mines, 18th and E Sts., N.W., Washington, D.C. 20240.)

Presents information to aid prospective grantee institutions in preparing requests for scientific research support from the U.S. Department of the Interior, Bureau of Mines; offers suggestions concerning proposal format to facilitate consideration of research ideas on a fair and equitable basis.

2334. **Brooks, H., "What's Happening to the U.S. Lead in Technology"**, *Harvard Business Review*, **v. 50, no. 3, May-June 1972, pp. 110-118.**

Describes the change in attitude over the past few years from complacency over the U.S.'s safe lead in technology to despair as to whether the U.S. can catch up; contends that the true position today lies somewhere in between, noting that imbalances tend to correct themselves; concludes that the increasingly international nature of the scientific system, with science and technology being introduced and diffused by international institutions, will render the concept of national superiority obsolete, with all nations approaching a common level.

2335. **Holloman, J. H., "Technology in the United States: Issues for the 1970's"**, *Technology Review*, **v. 74, no. 7, June 1972, pp. 11-21.**

Examines the process of technological change; the nature of existing public policies and programs that affect technological change, both in the U.S. and in other industrialized nations; the U.S.'s most important resource for technological change – trained scientists and engineers; and the role that R&D plays in the private sector and in the technological development of other industrialized nations; concludes that while the U.S. must reexamine and revise national policies for technology, caution must be exercised and future policy alternatives carefully analyzed before initiating any new policy.

2336. *The Role of Engineers and Scientists in a National Policy for Technology*, **Fourth Annual Report of the National Science Board, 1972, 48 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 45 cents.)

Recommends government support of industrial technology, government-aided R&D to provide technological support for public goods and services, exploration of problems of national importance and of alternatives for dealing with them, promotion of public understanding of technology, and development of means for technology assessment; urges greater participation of scientists and engineers in early deliberations on technical issues and in government policy and decision making processes.

2337. **Simpson, R. O., "Partners in Action in Science and Technology", Remarks before the National Action Conference on Intergovernmental Science and Technology Policy, Harrisburg, Pa., 22 June 1972,** *U.S. Department of Commerce News*, **8 pp.**

Deputy Assistant Secretary of Commerce Simpson iterates the ways in which the U.S. Department of Commerce is contributing to Nixon's new Federalism: Bureau of Standards' Federal-State-local program in weights and measures, National Conference of States on Building Codes and Standards, R&D for the Law Enforcement Assistance Administration, development of voluntary product standards, and coordination of the National Standard Reference Data System on properties; points also to the Department's National Technical Information Service, Economic Development Administration, Office of Telecommunications, and mandate to liberalize U.S. patent policies; describes projected activities under the NBS Experimental Technology Incentives Program to stimulate private R&D.

2338. **"Small R&D Firms Vie for More Federal Money"**, *Chemical & Engineering News*, **v. 50, no. 26, 26 June 1972, pp. 2, 6.**

Describes activities at a 3-day conference sponsored by the National Science Foundation, the Small Business Administration (SBA), and the Commerce Department entitled, "Survival and Growth: The Small R&D Firm", with emphasis on survival; reviews the dialogue between executives of small R&D firms and important officials of major Federal agencies that fund R&D; lists recommendations and initiatives agreed upon at the conference, including the development of a lending program by the SBA tailored to small R&D firms, and Federal guarantees of up to 50% on equity capital provided by investment banking organizations.

2339. **"Government Aims at Open Information Policy"**, *Chemical & Engineering News*, **v. 50, no. 26, 26 June 1972, pp. 8-9.**

Describes recent efforts by the Environmental Protection Agency and the Food & Drug Administration to comply with the encouragement offered in the Freedom of Information Act of 1967 to open their records to the public; discusses EPA's plans for dealing with public disclosure of trade secrets and privileged or confidential information supplied the agency by industry; describes the types of data which will be made public by the FDA (safety and effectiveness, complaints, correspondence and discussions, operating manuals, and enforcement actions).

HEALTH AND SAFETY

2340 *Selected Sources of Information on Hazardous Materials*, **Library of Congress, 1972, 7 pp.** (Available from National Referral Center, Science and Technology Division, Library of Congress, Washington, D.C. 20540.)

Provides data on 53 organizations, with a description of the information services (concerning for example, the handling or transportation of hazardous materials)

which can be performed for the public or selected users.

2341. **McKenzie, S., "A Counterbudget for Health"**, *sppsg Newsletter*, **v. 3, no. 3, March 1972, pp. 4-5.**

Presents recommendations of the Coalition for Health Funding concerning the Administration's health budget for FY 73, which the Coalition claims is $2.7 billion short of meeting the nation's health needs: raising NIH's funding increase over FY 72 ($139 million) by $300 million, increasing the Health Services and Mental Health Administration budget by $1.3 billion, and increasing the budget for NIH's health manpower program by $1 billion to provide funds for construction of health-professions schools.

2342. *Center for Law and Health Sciences, Annual Report, 1970-1971*, **13 pp.** (Available from Center for Law and Health Sciences, Boston University School of Law, 765 Commonwealth Ave., Boston, Mass. 02215.)

Reviews the 1970-71 activities of the Center in health insurance reform; prenatal diagnosis, genetic counseling, and public policy; bioengineering and social control; and child development; describes programs planned for 1971-72 centered in 3 main areas: delivery of health services, implications of science and technology for medicine and society, and child development.

2343. **"NCI Announces Award for Fort Detrick"**, *Science*, **v. 176, no. 4042, 30 June 1972, p. 1402.**

Reports on the announcement by National Cancer Institute director F. J. Rauscher that Bionetics Research Laboratories had been awarded a $6.8 million contract to begin converting the Army's former biological warfare facilities at Fort Detrick, Md., into a cancer research center for virus production, animal holding, and other support services (planned to build up to $15 to $20 million annually by 1977); implies that Detrick's 286 buildings are far too extensive (especially since NIH has not yet filled its new $3 million high-containment laboratory in Bethesda), and indicates that the conversion move stems from the 1971 White House cancer crusade "to offset Sen. Kennedy's initiatives in the cancer field".

2344. **Culliton, B. J., "Institute of Medicine: Taking on Study of Cost of Medical Education"**, *Science*, **v. 176, no. 4038, 2 June 1972, pp. 997-999.**

Discusses the Institute of Medicine's (IOM) plans to conduct a study to provide Congress with information on the cost of medical education, as requested in the Comprehensive Health Manpower Training Act of 1971, which may include determination of educational costs for 7 other categories of health professionals; presents views expressed by participants at a 2-day meeting to consider means by which the IOM can provide definitive guidance to health legislators; also discussed was the question of the IOM's possible impact on public health policy and the question of its conduct of health policy research.

HOUSING AND CONSTRUCTION

2345. **Bernhardt, K. L. (Ed.)**, *Housing: New Trends and Concepts*, **Industrial Development Division, Institute of Science and Technology, The University of Michigan, 1972, 169 pp.** (Available from Industrial Development Division, Institute of Science and Technology, 2200 North Campus Blvd., Ann Arbor, Mich. 48105. Price: $3.00.)

Presents a collection of papers focusing principally on the various aspects of industrialized housing; among the papers are: "The Federal Role in Meeting the Housing Needs of the Future: (H. B. Finger), "The Impact of Industrialized Housing on Today's Builders" (S. Edge), "The Consumer Demand for Housing" (W. R. Smoklin), "Critical Considerations in Planning an Industrialized Manufacturing Operation" (T. R. Arnold), and "Marketing to the Public and Private Sectors" (A. E. Rosfeld); also covers such topics as new breakthroughs in manufacturing technology and the availability of utilities for housing in the 1970's.

2346. **Pearson, K. G.**, *Industrialized Housing*, **Industrial Development Division, Institute of Science and Technology, The University of Michigan, 1972, 94 pp.** (Available from Industrial Development Division, Institute of Science and Technology, 2200 North Campus Blvd., Ann Arbor, Mich. 48105. Price: $3.00.)

Defines industrialized housing and discusses the growth and future development of

the industry; examines key aspects: materials and assembly, transportation and erection, building codes, financing, and marketing; includes a separate chapter on mobile homes and an appendix which summarizes the operations of 66 industrialized housing producers.

INDIA

2347. **Agarwal, A. K., "Is India Ready for Satellite TV?",** *New Scientist,* **v. 54, no. 794, 4 May 1972, pp. 279-280.**

Describes the promise of a community television network system for India, the development of which has been arrested by controversy over the type of infrastructure that should be used for the national grid – a communications satellite or a network of production centers and TV transmitters; discusses the implications of India's lack of adequate software, and the ISRO-NASA Satellite Instructional Television Experiment (due in 1974) which may determine the extent of India's entry into the "television era".

INFORMATION MANAGEMENT

2348. **"Do Technical Reports belong to the Literature?",** *Nature,* **v. 236, no. 5345, 7 April 1972, p. 275.**

Examines questions concerning the widespread distribution of technical reports and how they can become part of the scientific literature; discusses the need for such reports to conform with standards set for other forms of scientific literature regarding references, nomenclature, system of units, and construction of text, and for the reports to be thoroughly edited.

2349. *National Environmental Information Symposium,* **to be held at Cincinnati, Ohio, 24-27 September 1972.**

This Symposium, to be sponsored by the Environmental Protection Agency, will serve two purposes: (1) to provide a forum for producers and handlers of environmental data to identify and explain resources and methods to help users better meet their information needs; (2) to bring together citizen's organizations, universities, libraries, professional and trade associations, and governmental bodies to share objectives and interests related to the production, use, and dissemination of environmental information. (For further information contact Mr. G. M. Gigliotti, Director, Public Affairs Office, National Environmental Research Center, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.)

2350. **Butler, J. N., "Information Pollution and the Ignorance Explosion",** *Chemical Technology,* **March 1972, pp. 139-141.**

Describes the "information pollution" problem and offers a possible solution: balancing information consumption against information production by more versatile retrieval methods, and bringing together information not previously associated; points out that the exponential nature of the growth of information actually results in an ignorance explosion, since the individual scientist is unable to cope with the increased amount of available information, and suggests that an exponential increase in information-handling ability might offer a partial remedy.

2351. *Report on the Bibliographic Facilities of the Science Studies Library,* **University of Edinburgh, January 1972, 8 pp.** (Request to be put on the mailing list for this report and future bibliographies should be sent to The Secretary, Science Studies Unit, Edinburgh University, 34 Buccleuch Place, Edinburgh EH8 9JT, Scotland, U.K.)

Announces the availability in Strip Index form, of 3 bibliographies: Chemical and Biological Warfare, Environmental Pollution, and Ecology and the Natural Environment [see *SPR* 4(2):435], as well as listings of topics of current interest in the Unit, e.g., the Alaskan pipeline project and weather forecasting and modification; other bibliographies prepared include Technological Forecasting and Education in Science; includes a list of subject headings used in the bibliographies.

2352. *A Directory of Information Resources in the United States: Physical Sciences, Engineering,* **Library of Congress, 1971, 803 pp.** (Available from National Referral Center, Science and Technology Division, Library of Congress, Washington, D.C. 20540. Price: $6.50.)

Lists in the directory's 2,891 entries the address, telephone number, area of interest, holdings, publications, and information services of a wide variety of organizations capable of meeting specific information needs, including: libraries, information centers, professional societies, industrial firms, and Federal, state, and local government offices; includes a subject index.

2353. **"Survey of Demand for Creating, and Ways of Setting Up, a UNESCO-sponsored International Retrieval Service in Science Policy"**, *sppsg Newsletter*, **v. 3, no. 3, March 1972, p. 21.**

Reports that UNESCO is collecting data preparatory to compiling a Science Policy Thesaurus for the indexing and retrievel of science policy literature from 1975 on, through a survey of the opinions of the potential users; for further information, write to Director, Science Policy Division, UNESCO, Place de Fontenoy, Paris 7ème, France.

INTERNATIONAL SCIENCE ACTIVITIES

2354. *Report of the Foreign Secretary, National Academy of Sciences*, **April 1972, 29 pp.** (Available from National Academy of Sciences, 2101 Constitution Ave., Washington, D.C. 20418.)

Reports briefly on current involvement with other academies, international population problems, international organizations and programs, exchange programs with Soviet and East European Academies of Sciences, and scholarly communication with the Peoples Republic of China; describes workshop programs, specifically two regional workshops having the common theme of interaction of economic development and environmental protection; describes plans for future programs.

2355. **"U.S.-U.S.S.R. Cooperation in Science and Technology Agreement"**, *Weekly Compilation of Presidential Documents*, **v. 8, no. 23, 5 June 1972, pp. 921-922.**

Comprises 8 articles, with article 7 calling for the establishment of a U.S.-U.S.S.R. Joint Commission on Scientific and Technical Cooperation which will facilitate implementation of the agreement; specific areas of mutual benefit will not be identified until the Commission becomes functional, but possibilities include: energy research, arctic research, and management science.

ISRAEL

2356. **"Israel Institute for Biological Research"**, *International Science Notes*, **no. 27, May 1972, pp. 7-8.**

Describes the objectives, facilities, and general organization of the Institute which is under the jurisdiction of the Israeli Prime Minister's Office; research projects conducted there include some funded by the U.S. National Institutes of Health, the National Communicable Disease Center of the U.S. Public Health Service, the U.S. Department of Agriculture, the Ford Foundation, and the World Health Organization.

2357. **Miller, J., "Israel: Pollution Problems Rife, but Other Issues Take Priority"**, *Science*, **v. 176, no. 4036, 19 May 1972, pp. 781-784.**

Examines the overall situation in Israel as it pertains to pollution control, and discusses the problems posed by factors peculiar to that country; describes the increasing concern for the environment and the activities of the recently established Israel National Committee on the Biosphere and Environment which include: studying the effects of environmental pollution; identifying key pollution areas, and recommending suitable legislation and other actions; educating the public about environmental concerns; and preparing a master plan for national action for protection of the environment.

ITALY

2358. **Kolcum, E. H., "The Italian Aerospace Industry"**, *Aviation Week & Space Technology*, **v. 96, no. 23, 5 June 1972, p. 9.**

Discusses what the Italian aerospace industry must do if it is to exploit its genuine

capabilities, the two basic ingredients being: rapid evolution of Aeritalia into an effective development and production company, and commitment by the government to a baseline program that will enable the industry to plan beyond the frequent changes in government administrations; discusses Italy's need for increased government support of air defense.

2359. **"Government Key to Future Growth"**, *Aviation Week & Space Technology*, **v. 96, no. 23, 5 June 1972, pp. 30-35.**

Assesses the possible future participation of the Italian aerospace industry in European and U.S. projects, which will depend largely on the stability and financial support of the Italian government; describes the significance of Aeritalia as a means of realizing Italy's considerable aerospace potential, since the Finmeccanica part of the company is government-owned and thus is virtually assured of government financing; outlines projects now under consideration, and describes the Italian aerospace industry's dependence upon U.S. technology and the U.S. market for future programs.

JAPAN

2360. **"Japan: Science and Technology Topics"**, *International Science Notes*, **no. 27, May 1972, pp. 3-6.**

Assesses the overall situation in Japan regarding allocation of government R&D funds, technology imports and exports, antipollution expenditures by industry, atomic energy policy development, and uranium supply; predicts continued reliance on imported technology, increased exportation of Japanese technology, and continued dependence on U.S. pollution control technology; describes Japan's plans for uranium-ore exploration and development of uranium-enrichment technology.

2361. **"Japanese Government Assistance to Private Industry's Pollution Control"**, *International Science Notes*, **no. 27, May 1972, pp. 6-7.**

Describes the major Japanese governmental effort to stimulate the installation of pollution-control equipment, to relocate factories, and to shift production to nonpolluting activities through tax incentives and low-interest loans, with total government assistance for pollution control expected to approximate $500 million in FY 1972.

2362. **"Special Report: Learning the Secrets of Japanese Success"**, *Science Forum*, **v. 5, no. 3, June 1972, pp. 14-15.**

Reviews prime factors in Japan's economic success: the high percentage of R&D that is funded by business (70%); government insistence on Japanese control of firms and on screening of technology imports; a strong alliance among banking, manufacturing, and distributing organizations; and careful screening of licensing agreements; observes that while Japan "bought" its technology abroad, mostly from the U.S., the instrumentation used in university, government, or industrial laboratories is produced domestically; outlines the four areas of priority now receiving high funding levels: space, oceanography, nuclear energy, and environmental protection.

2363. *The Industrial Policy of Japan*, **Organization for Economic Co-operation and Development, 1972, 195 pp.** (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $4.25.)

Presents a comprehensive discussion of the basic philosophy and objectives of Japanese industrial policy, and the whole range of policy instruments and means used to promote industrial development, structural adaptation, and the stimulation of technological progress in industry; provides a thorough assessment of those policies; contains 11 chapters, plus conclusions, and 4 annexes covering, for example, Japanese Government budgetary and organizational data and general statistical data.

2364. **McAbee, M. K., "Japanese Worker: Not-So-Cheap Labor"**, *Chemical & Engineering News*, **v. 50, no. 22, 29 May 1972, pp. 7-9.**

Notes the vastly lowered number of man-days of lost production (compared with the U.S.) which results from the fact that Japanese labor unions are organized on

a single-company basis, and call strikes generally to signal workers' unity in backing their demands, not to halt company operations until those demands are met; describes the Japanese worker/company relationship, which is exemplified by the lifetime hiring policy of most companies, and its relation to Japan's vigorous economic growth.

MANAGEMENT OF SCIENCE

2365. **Gee, R. E., "The Opportunity Criterion – A New Approach to the Evaluation of R&D",** *Research Management,* **v. 15, no. 3, May 1972, pp. 64-71.**

Discusses the necessity for evaluating R&D and suggests a new management concept – a measure of R&D's ability to generate profitable business opportunities – which will provide a more realistic, accurate, and useful value indicator; describes the concept and offers suggestions regarding its use.

2366. **Stever, H. G., "New Dimensions of Research Cooperation",** *Research Management,* **v. 15, no. 3, May 1972, pp. 23-29.**

Describes new programs being planned by the National Science Foundation, designed to improve cooperation in R&D among industry, the government, and the academic community, and to seek means of promoting the transfer of ideas from the laboratory to the industrial and public service sectors (the innovation process).

2367. **Siu, R.G.H., "Arrangement Making in a Time of Stress",** *Research Management,* **v. 15, no. 3, May 1972, pp. 13-22.**

Describes the past attitudes toward the R&D community and those existing today; discusses the present arrangements for conducting R&D in the industrial, academic, and governmental sectors, and the adjustments these sectors must make to establish social relevance and enable them to respond effectively to societal needs.

2368. **Walsh, J., "OECD: Report Sees Closer Links between Research, Social Objectives",** *Science,* **v. 176, no. 4031, 14 April 1972, pp. 151-153.**

Reviews the OECD's report on its comparative study of the organization and financing of fundamental research in France, Germany, and the U.K., which reveals that for all three countries fundamental research is conducted by universities plus some type of peripheral system, and the proportion of R&D devoted to basic research is about the same; describes differences in funding patterns among these countries and major problems common to all.

2369. **Sporn, P., "On the Control of Science: A Critique",** *Bulletin of the Atomic Scientists,* **v. 28, no. 6, June 1972, pp. 13-19.**

Takes issue with some of the views expressed in the 4 papers forming the Northwestern University Colloquium on "The Control of Science for Civil Need" [see *SPR* 4(4):1531]; levels criticism particularly against (1) a proposal for strengthening international institutions as media for control of science, (2) support of technology assessment, (3) the view that science is neutral, and (4) the proposition that an interdisciplinary effort by engineers and social scientists is necessary to the solution of many of society's problems; asserts that only when all segments of society (the laborer, the farmer, the business man, and professional) integrate ethics and morality into their personal, professional, business, and working lives will we be able to solve such problems as war, poverty, disease, and pollution; includes rebuttals by Drucker and Tribus.

MANPOWER – TECHNICAL AND SCIENTIFIC

2370. *American Science Manpower, 1970,* **A Report of the National Register of Scientific and Technical Personnel, National Science Foundation Report NSF 71-45, October 1971, 258 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00.)

Presents detailed statistical information on scientific manpower, including education, employment, salary, field and subfield of science, state and metropolitan-area distribution, and support by Federal Government funds.

2371. **"Total Scientific and Technical Personnel in Industry Remains Level. R&D Personnel**

Lower in 1970", *Science Resources Studies Highlights*, **National Science Foundation Report NSF 72-306, 26 April 1972, 4 pp.**

Highlights the major findings of the 1970 survey of scientific and technical personnel in industry conducted by the Bureau of Labor Statistics, and compares results with those of 1969; shows the level of employment for various occupations in selected industries; reports that between January 1969 and January 1970, the U.S. civilian labor force rose 3.2%, total employment 2.6%, and employment in professional and technical occupations 2.5%; meanwhile, scientists and engineers engaged in R&D activities dropped by 4%.

2372. *Summary Report, 1971 Doctorate Recipients from United States Universities*, **National Research Council, National Academy of Sciences, National Academy of Engineering, April 1972, 14 pp.** (Available from Office of Scientific Personnel, National Research Council, 2101 Constitution Ave., Washington, D.C. 20418.)

Presents tables showing number of doctorate recipients by subfields, a statistical profile of recipients by field of doctorate, the percentage of recipients by sources of support in graduate school by summary fields, and number of recipients by state and summary field and number of institutions; summarizes postgraduation plans of doctorate recipients.

2373. *Scientific and Technical Manpower Requirements of Selected Segments of the Atomic Energy Field*, **U.S. Atomic Energy Commission, Division of Nuclear Education and Training, August 1970, 246 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00.)

Projects primarily the manpower requirements for scientists, engineers, technicians, nuclear-reactor operators, and nuclear materials managers, with considerable emphasis also given to the need for nuclear-degreed scientists and engineers by the sectors of the atomic energy field covered by the study; the data included in the study represent only technical personnel who will spend at least 50% of their working time in atomic energy activities.

2374. **"Less Engineers on the Campus"**, *Industrial Research*, **v. 14, no. 5, May 1972, p. 30.**

Reports a decline in number of students enrolled in U.S. engineering schools, particularly in the freshman class (18% smaller or 26,000 fewer students); notes the serious implications of this decline with regard to the future supply of technically trained manpower; enrollment in the physical sciences also declined, from 2.3% of the total in 1970 to 2.0% in 1971.

2375. **"Science Career Prospects"**, *Washington Science Trends*, **v. 28, no. 12, 26 June 1972, pp. 67-68.**

Predicts a shortage of scientists by the late 1970's if current trends in graduate enrollment continue; suggests that students should be counseled on the probabilities for carrying out specific activities, such as research, and the opportunities and challenges in nonresearch activities; advises universities and colleges to offer broader and more diverse training programs, which could include work-study programs or internships to give students direct experience with various types of science activities and different types of employers.

2376. **"Job Picture for New Grads Improves"**, *Chemical & Engineering News*, **v. 50, no. 26, 26 June 1972, p. 2.**

Describes the unanticipated improvements in the graduate employment picture for the first half of 1972; discusses a 52% increase in hiring of graduates in chemistry, and a 43% increase in aerospace which most likely resulted from renewed activity in the National Aeronautics and Space Administration's space shuttle program.

2377. **"R & D Manpower Demand to Outstrip Supply"**, *Industrial Research*, **v. 14, no. 5, May 1972, p. 30.**

Cites projections concerning the employment picture for engineering graduates in 1975-80, when the demand is expected to exceed the supply, a situation partly brought about by a reduction in the number of graduates due to the recent economic slowdown and public disenchantment with technology.

2378. **"Demand for Engineers to Increase"**, *Chemical & Engineering News*, **v. 50, no. 19, 8 May 1972, p. 23.**

Predicts a sharp increase in the demand for engineering graduates by 1975-76, with

the job market requiring 42,000 new engineers annually throughout this decade; expects an employment increase regardless of any drop in aerospace or defense programs.

2379. **"Engineering Employment and Unemployment, 1971"**, *Engineering Manpower Bulletin*, **no. 19, October 1971, pp. 1-6.**

Highlights the national survey of engineering employment conducted by the Engineers Joint Council, and interprets some of its results in relation to engineering manpower trends; concludes that the employment rate for all engineers might have been as high as 3.4% during 1971, and presents the "employment problem" rates corresponding to specific engineering areas, showing aerospace and business administration among the highest, and civil and agricultural among the lowest; shows unemployment as a function of education; recommends that existing Government programs be adjusted to provide assistance to groups outside of the aerospace locations.

2380. **"Women in Engineering"**, *Engineering Manpower Bulletin*, **no. 21, May 1972, pp. 1-6.**

Discusses the status of women in engineering, attempting to counteract some of the misconceptions about the opportunities available to women engineers; presents charts showing the involvement of women in engineering, salaries, and distribution by engineering fields; discusses the problems women face in entering the engineering profession, the dominant one being overcoming the male image attached to the profession.

2381. **"The Future of Training in Biomedical Engineering"**, *IEEE Transactions on Biomedical Engineering*, **v. BME-19, no. 2, March 1972, 8 pp.**

Assesses manpower needs in Biomedical Engineering, and concludes that "in the long range, the need for biomedical engineers . . . will meet or exceed the capacity of the [U.S.] education system to produce them"; outlines the areas in which biomedical engineering PhD's will be needed: industry, hospital R&D, and academic institutions; suggests that biomedical training should not be narrowly mission-oriented, and emphasizes that "a balanced collection of several means for the governmental support of graduate students . . . is especially important to new 'emerging disciplines' such as biomedical engineering".

2382. **Shapero, A., "Making the Technical Unemployed Productive Again"**, *Innovation*, **no. 31, May 1972, pp. 38-47.**

Examines the problem of the unemployed scientists and engineers, and the underlying forces contributing to this unemployment: a general economic slowdown, heavy curtailment of programs for space, defense, and academic research, a decline in the demand for teachers, and the growing output of educated manpower; describes the ineffectiveness of various programs to reemploy technical manpower, sponsored by such elements as the Federal Government, local and state governments, professional societies, and universities; offers suggestions as to kind of program needed: for example, a major national program for technology transfer through a series of profit-making organizations that will use government financing and government technology.

2383. *Highlights of Engineering Manpower Commission's Activities, January-March, 1972*, **Press Release from Engineering Manpower Commission, Engineers Joint Council, 2 pp.** (Available from John D. Alden, Executive Secretary, Engineering Manpower Commission, Engineers Joint Council, 345 East 47th Street, New York, New York 10017.)

Summarizes the activities of the Engineering Manpower Commission (EMC) in carrying out its announced intention of giving top priority to the "creation of job opportunities and the reorientation of personnel within their broad fields of competence"; the EMC concluded that "retraining of engineers for jobs that turn out to be nonexistent is a waste of resources and a source of frustration to the trainee", and recommended that retraining programs be undertaken only where the availability of jobs has been verified.

2384. **"New Skills for Out-of-Work Engineers"**, *Environmental Science and Technology*, **v. 6, no. 4, April 1972, pp. 316-317.**

Describes a 6-month retraining program in water-pollution control at Grumman Aerospace Corp. headquarters in Bethpage, New York, for unemployed aerospace engineers; the course involves over 600 hours of instruction in subjects ranging

from microbiology to instrumentation, and Grumman's professional staff provides the instructors, with two consulting engineers teaching the design courses.

2385. **O'Lone, R. G., "Some Economic Sun in Seattle, But the Chill Lingers"**, *Aviation Week & Space Technology*, **v. 96, no. 24, 12 June 1972, pp. 12-16.**

Examines the economic crisis in Washington State, triggered by the "aerospace depression" and aggravated by the national recession; outlines the factors expected to counterbalance Boeing Co.'s probable increase in employment, including: a continuing high unemployment rate in other sectors, expiration of unemployment compensation benefits, and a rapidly growing labor force; summarizes the findings of a study on career changes for scientists and engineers, conducted by the Human Affairs Research Centers of Battelle Institute's Pacific Northwest Laboratories, which recommend that a program be launched to place 200 engineers and scientists in new careers.

2386. *Scientists Abroad: A Study of International Movement of Persons in Science and Technology*, **United Nations Educational, Scientific and Cultural Organization, 1971, 147 pp.** (Available from Unesco Publications Center, P.O. Box 433, New York, N.Y. 10016. Price: $3.00.)

Traces the international movement of scientists, engineers, and technicians, assesses its relationship to national development, and presents suggestions for short- and long-term solutions to the problems posed by this movement; Part I details the permanent migration of talented individuals from developing countries to developed countries; Part II is the result of a Unesco survey compiled from questionnaires concerning travel by scientific and technical personnel as well as foreign students; Part III focuses on the future and offers suggestions on information needed, as well as indicating the relationship between science policy and the development process.

2387. **Maybury, R. H., "Foreign Job Opportunities"**, *Chemical Technology*, **March 1972, pp. 153-155.**

Discusses the reverse "brain-drain" from America to overseas; notes that while the overall need for American talent overseas appears unfavorable because of regulations governing the hiring of foreigners, jobs in service areas, such as education, industry, and management are available, that is, U.S. scientists can teach overseas, and there are opportunities for university research and in specialized technical projects; points out that the determining factor in length of stay will be the policies and practices of the country regarding work permits.

METRICATION

2388. **"To Keep the Ball Rolling"**, *Nature*, **v. 237, no. 5350, 12 May 1972, p. 65.**

Reviews the Report of the Metrication Board, 1971, which describes the progress made in Britain in 1971 toward changing over to the metric system; the Board concludes that the rate of metric change must be speeded up and that Britain can substantially accomplish the changeover by 1975, if given a firm lead by the government.

2389. **Cotton, N., "National Policy on Conversion to Metric System"**, *Congressional Record*, **v. 118, no. 48, 28 March 1972, pp. S4857-4859.**

Reprints the text of a joint resolution to establish a national policy for conversion to the metric system in the U.S., along with the transmittal letter and a statement of purpose and need; the chief intent of the resolution is that metric units would become the predominant measurement language in the U.S. within 10 years of its enactment.

NATIONAL SECURITY

2390. **"Administration Continues Firm in On-Site Inspections Demand"**, *Aviation Week & Space Technology*, **v. 96, no. 21, 22 May 1972, p. 13.**

Reviews testimony expressing mixed views concerning the necessity for on-site inspections as a condition of the proposed U.S. nuclear test ban treaty with the Soviet Union, with proponents describing various detection-evasion techniques, and

the opponents contending that improved seismic techniques, satellite photography, and heat-sensing techniques make on-site inspections unnecessary.

2391. **"DoD Keeps Control"**, *Nature*, **v. 237, no. 5354, 9 June 1972, p. 308.**

Discusses unsuccessful attempts to have the Defense Department's seismology research program transferred to the Arms Control and Disarmament Agency (ACDA); the program is designed to provide the theoretical backing for a monitoring system to police a possible treaty banning all testing of nuclear weapons; it has 3 parts: (1) pinpointing geographical areas subject to anomalous seismic events, (2) designing a worldwide monitoring network, and (3) detection of clandestine tests and consideration of "the impact of non-seismic means to deter the use of potential evasion techniques".

2392. **Winston, D. C., "Arms Pact to Slash DOD Budget"**, *Aviation Week & Space Technology*, **v. 96, no. 23, 5 June 1972, pp. 14-15.**

Presents the major provisions of the U.S.-U.S.S.R. treaty, which is expected to result in a $500 million cut in the DOD Fiscal '73 budget, and discusses the possible effects on uture budgets and weapons planning; immediate results include cessation of research, development, test, and evaluation work on some aspects of Safeguard and the Hardsite advanced ABM systems, and the initiation of planning for a Safeguard complex at Washington, D.C.; further discussions are expected concerning broadening the interim agreement to cover other weapons systems and the possible destruction of some weapons.

2393. **Winston, D. C., "Arms Pact Disparity Laid to Technology"**, *Aviation Week & Space Technology*, **v. 96, no. 24, 12 June 1972, pp. 21-22.**

Reports that U.S. negotiators at the recent Strategic Arms Limitation Talks (SALT) granted the Soviet's numerical advantage in offensive missiles for 2 reasons: to stop that country's deployment momentum, and because of the U.S.'s 2-year lead over Russia in weapons technology; cites statements by Defense Secretary Laird which emphasized that implementation of the interim arms agreement must be matched by accelerated U.S. investment in advanced weapons systems development in order to maintain the current U.S. technological advantage and to prepare for the next round of SALT; describes arms and budget reductions resulting from the SALT agreement.

2394. **Martin, J., Jr., "United States Discusses Chemical Weapons and Other Arms Control Issues"**, *U.S. Department of State Bulletin*, **v. 66, no. 1719, 5 June 1972, pp. 792-801.**

Suggests that the U.S. "pursue a negotiating process of first examining with other members [of the Committee on Disarmament] the basic elements of possible limitations" as a basis for forming conclusions on practical solutions; recommends that provisions of the Biological Weapons Convention not be adopted for the Chemical Weapons agreement without further study; asserts that U.S. is skeptical of the value of a world disarmament conference – since this is one of the purposes of the General Assembly; includes the text of the U.S. working paper on prohibition of Chemical Weapons.

2395. **Fineberg, R. A., "Army May Resume Nerve Gas Testing"**, *Congressional Record*, **v. 118, no. 105, 27 June 1972, pp. S10307-10308.**

Reports that the U.S. Army is preparing an environmental impact statement and intends to resume open air testing of lethal chemical weapons, at Dugway Proving Grounds, Utah, according to a press briefing (the first in 17 years); refers to a new chemical binary weapons system (where 2 harmless chemicals in separate cylinders are mixed on firing to form a lethal compound), which is expected to replace existing chemical stockpiles.

2396. **Biaggi, M., "Biaggi Warns of U.S. Lag in Marine Sciences Technology"**, *Congressional Record*, **v. 118, no. 95, 13 June 1972, pp. E6150-6151 (Reprint of June commencement speech at the N.Y. State Maritime College at Fort Schuyler).**

Rep. Biaggi points out a new and serious threat to the international leadership of the U.S. – the "sea gap"; emphasizes the urgent need to expand U.S. support of R&D in the maritime sciences, contending that the State maritime academies are the institutions best designed to fulfill this role.

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NETHERLANDS

2397. **DeKool, A., "Netherlands: Proposals for Reforming University Science", *Nature*, v. 237, no. 5352, 26 May 1972, pp. 211-212.**

Describes measures to improve the structure of Dutch science and technical education, beginning with last year's creation of a Minister for Higher Education [*SPR* 4(2):649]; notes university objections to suggestions that a general curriculum be taught at every university, that the Government decide how many students a given department should have, and that scientific frontier research be removed from universities and done in extramural institutes.

OCEAN – INTERNATIONAL ACTIVITIES

2398. *Introduction to World Data Center A: Oceanography*, **1972, 11 pp.** (Available from World Data Center A, Oceanography, National Oceanic and Atmospheric Administration, Rockville, Md. 20852.

Presents background information on the World Data Center System and describes Data Center A's responsibilities, the types of data in its archives, services it provides, and its publications.

2399. **Moffat, R. E., and Trammell, E. G., Jr. (Preparers),** *Semiannual Report of Oceanographic Data Exchange Through 30 June 1971*, **World Data Center A: Oceanography, December 1971, 28 pp.** (Available from World Data Center A: Oceanography, National Oceanic and Atmospheric Administration, Rockville, Md. 20852.)

Summarizes data exchange activities of the Center for the first half of 1971 and includes tabulations of data received prior to this period; compares, by individual nation, the number of programs declared for international exchange of data and the number of these for which the Center has received data.

2400. **Moffat, R. E., and Trammell, E. G., Jr. (Preparers),** *Oceanographic Data Exchange, 1970*, **World Data Center A: Oceanography, August 1971, 28 pp.** (Available from World Data Center A: Oceanography, National Oceanic and Atmospheric Administration, Rockville, Md. 20852.)

Summarizes data on hand and received by the Center, tabulated according to nation, national and international programs, number of cruises, and types of format and observations as applicable; also summarizes international cooperative program data inventory forms received and information supplied by the Center to other nations and international organizations.

2401. **Stevenson, J. R., "Department Discusses Progress Toward 1973 Conference on the Law of the Sea",** *U.S. Department of State Bulletin*, **v. 46, no. 1715, 8 May 1972, pp. 672-679.**

Discusses U.S. policy concerning territorial sea and straits, limits of seabed resources, and freedom in scientific research, and describes the efforts of the U.S. directed toward international regulation of ocean pollution; recounts the latest developments in the preparations for the 1973 Conference and suggests areas where international agreement may be attained.

2402. *International Marine Science Affairs*, **A Report by the International Marine Sciences Affairs Panel of the Committee on Oceanography, Division of Earth Sciences, National Research Council, National Academy of Sciences, 1972, 92 pp.** (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $4.75.)

Identifies 5 principal tasks on which international cooperation is needed: (1) study of ocean processes; (2) provision of global marine science services (e.g., information exchange, standardization of methods); (3) regulations for rational use of the ocean; (4) facilitation of ocean research activities; and (5) provision of assistance to developing nations; proposes a framework for developing U.S. national and international ocean science policy directed toward establishing political arrangements that will facilitate performance of those tasks.

2403. **"Scientists of Five Nations to Explore Sunken Mid-Atlantic Mountain Range",** *U.S. Department of Commerce News*, **NOAA 72-87, 29 June 1972, Washington, D.C. 20230, 4 pp.**

Reports plans to explore a giant submerged mountain range in the mid-Atlantic for valuable mineral deposits and for clues to the origin of earthquakes by the U.S., England, Portugal, Spain, and Mauritania; reports that a second objective of the expedition is to determine the original edge of the northwest African continental margin; presents a drawing of a possible position of the continents 200 million years ago and of the route to be taken by the NOAA expedition ship *Discoverer*.

OCEAN – RESOURCES

2404. **Ellender, A. J., "Development of Mineral Resources of the Outer Continental Shelf",** *Congressional Record,* **v. 118, no. 69, 1 May 1972, pp. S6984-6987.**

Describes the benefits that would accrue to society and to the economy from orderly, more productive development of the mineral resources of the Outer Continental Shelf, which is urgently needed to meet future energy demands; reprints two articles describing studies which revealed that oil spills caused little damage to marine life; recommends close monitoring of each individual oil well and platform to assure that the operating procedures and safety measures employed meet established criteria.

2405. **Westman, W. E., "Development Offshore",** *Ecology Today,* **v. 2, no. 2, May/June 1972, pp. 11-13, 46, 48-49.**

Describes 6 new uses of coastal waters and the continental shelf now in the early stages of development and deployment: nuclear powerplant siting, oil exploration and extraction, desalination, sea thermal-gradient power plants, tethered kinetic reactors, and deuterium extraction for fusion power; examines the possible environmental hazards of thermal pollution, salinity, oil pollution, and the discharge of toxic and radioactive materials.

2406. **Malley, D. F., "Ocean Resources",** *Ecology Today,* **v. 2, no. 2, May/June 1972, pp. 2-5, 47-48.**

Calls attention to the importance of the ocean's vast resources to developing nations – particularly the potential for satisfying the protein hunger of their peoples; discusses limitations on the production and harvesting of these resources, and the effects of man's activities (e.g., the decrease in photosynthesis rates in marine algae as a result of a few ppm of DDT in the water, the effects of dams on fish and shrimp populations, eutrophication stemming from fertilizers washing into lakes, streams, rivers, and finally the oceans, and oil spills into the oceans); philosophizes on how much threat to the living resources of the ocean is justified in order to decrease hunger and poverty and raise standards of living in the immediate future.

OCEAN – U.S. ACTIVITIES

2407. *Marine Environmental Quality: Suggested Research Programs for Understanding Man's Effect on the Oceans,* **Report of a special study held under the auspices of the Ocean Science Committee of the NAS-NRC Ocean Affairs Board, August 9-13, 1971, National Academy of Sciences, 1972, 107 pp.** (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.)

Contains 6 chapters dealing with various aspects of marine pollution and presenting recommendations for its control; aspects covered include: types of marine pollutants, their dispersal and transport, biological exchange processes in relation to marine environmental quality, and effects on marine organisms.

2408. **Herbich, J. B.,** *Industry's Interest in Ocean Engineering Education Programs,* **Coastal and Ocean Engineering Division, Department of Civil Engineering, Texas Engineering Experiment Station, Texas A&M University, November 1971, 84 pp.** (Available from Sea Grant Program, Center for Marine Resources, Texas A&M University, College Station, Texas 77843. Price: $3.00.)

Presents results of a survey conducted to determine the viewpoint of industry regarding the subject matter that should be included in ocean-engineering education programs; principal courses recommended were: basic sciences, core material, applied sciences and humanities for an undergraduate curriculum, with basic

material and applications being deemed "most desirable" for a graduate program.

2409. **"EPA will build 'Artificial Ocean' to Test Oil Spill Cleanup Methods"**, *Environmental News*, **14 May 1972, 2 pp.**

Describes a new facility for testing, under realistic conditions, new types of booms, skimmers, and other devices used to contain or clean up spills of oil and other hazardous materials – an "artificial ocean" complete with a wave generator; data will be transmitted to a small control building for recording and processing.

PHILIPPINES

2410. **Lesaca, R., "Environmental Pollution is a Growing Menace"**, *Philippine Science Review*, **v. 11, no. 4, July-August 1971, pp. 15-20.**

Discusses the health, social, and economic hazards of pollution; briefly describes the Philippine Pollution Control Law of 1963 and public information campaign efforts; notes the pollution control efforts by government agencies other than the Commission established by the Pollution Control Law; research programs by the Commission include two on air-contaminant levels, two on effects of water pollution on fish, and one on classification of rivers and estuaries to establish the best usage of river water for the common good.

2411. **Santillan, F. LL., "Research and Invention Lead to Accelerated Economic Progress"**, *Philippine Science Review*, **v. 11, no. 4, July-August 1971, pp. 21-25.**

Calls for application of technological and management disciplines for economic and social progress in the Philippines; cites the Constitutional guidelines for the support of science, and outlines legislation which now constitutes a science policy, including the Science Act of 1958 under which NIST was expanded, the Philippine Inventors Incentives Act, the Patent Law of the Philippines, and the Special Science Fund Act; reviews the patent regulations and processes.

POLICY MAKING BODIES

2412. *The Science Committee: A Report by the Committee on the Utilization of Younger Scientists and Engineers in Advisory Services to Government*, **Office of Scientific Personnel, National Research Council, National Academy of Sciences, 1972, v. 1, 32 pp.; v. 2, 96 pp.** (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $4.95.)

Presents the findings and recommendations of a National Research Council study group formed to deal with questions concerning advisory committees; suggestions included: broadening the base of scientific advice to the government, broadening concerns to include greater recognition of social aspects of science and technology, opening the process to more public view, and the recruitment of younger scientists (under 35), more women, and more members of minority groups.

2413. **Culliton, B. J., "NAS: Academy Votes NRC Changes, New Formula on Classified Research"**, *Science*, **v. 176, no. 4034, 5 May 1972, pp. 499-501.**

Describes the new organizational structure of the National Research Council wherein the Council's disciplinary divisions have been replaced by multidisciplinary commissions and boards created to investigate a wide range of social and scientific questions; announces plans to involve young scientists in academy activities and provide excellent staff assistance through recruitment of postdoctoral fellows to serve as in-house resident scholars.

2414. **"Academy Reorganizing Research Council"**, *Washington Science Trends*, **v. 28, no. 4, 1 May 1972, p. 21.**

Points out that the National Academy of Sciences approved a plan to reorganize its $35 million-a-year National Research Council with its "myriad panels and committees"; describes the "anti-war" protest at the NAS annual meeting, where the President and Congress were asked to "evolve foreign policies in which the development and application of science and technology in industry, agriculture and health for the furtherance of human welfare are major elements and reliance on military force . . . is de-emphasized".

POLLUTION – AIR

2415. **"NOAA Scientists Testing Sound as Air Pollution Monitoring Technique"**, *U.S. Department of Commerce News*, **8 June 1972, pp. 1-4.**

Describes a special device, called an acoustic echo sounder, which has been under test since December 1971; discusses the potential which the device offers for improved air-pollution-control warnings and decisions, for enhancing the accuracy of pollution prediction, and for enabling scientists to recognize, in advance, the onset of severe pollution episodes.

2416. **Sawyer, R. F.,** *Atmospheric Pollution by Aircraft Engines and Fuels: A Survey*, **North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development, Report AGARD-AR-40, March 1962, 33 pp.** (Available from National Aeronautics and Space Administration, Attn: Report Distribution and Storage Unit, Langley Field, Va. 23365.)

Describes 27 current or potential problem areas in aircraft air pollution, identifying the most pressing areas: engine emission characteristics, test procedures, nitric oxide formation, carbon monoxide and hydrocarbons emissions at low power, and effect of high altitude emissions; outlines specific efforts needed in each area.

2417. **Malin, M., and Lewicke, C., "Pollution-Free Power for the Automobile",** *Environmental Science & Technology*, **v. 6, no. 6, June 1972, pp. 512-513, 515-517.**

Outlines the requirements of the Clean Air Act of 1970, and the plans of the Environmental Protection Agency to rigidly enforce it; describes various present methods of cleaning up the internal combustion engine (ICE), as well as potential methods still in the experimental stages, such as recirculation of exhausts and catalytic systems; discusses the advantages and disadvantages of the Wankle engine, electric motor, and diesel engine; describes the promising future of the gas turbine and steam engine as alternatives to the ICE.

2418. **Gilluly, R. H., "Nitrogen Oxides, Autos and Power Plants",** *Science News*, **v. 101, no. 16, 15 April 1972, pp. 252-263.**

Cites statements from an OST report (28 February 1972) and from one by the National Academy of Engineering/National Research Council, and testimony by P. Handler, President of the National Academy of Sciences, before the U.S. Senate, all of which suggest that air pollution may not be controllable by technological means, but only through drastic changes in national patterns of private, commercial, and industrial activity; presents the implications to be drawn from the OST and NAE/NRC reports: (1) automobile traffic must be severely restricted in many urban areas if air quality standards and public health goals are to be met; and (2) an expanded program for R&D of coal and oil gasification is necessary to abate NO_x emissions.

2419. **"Air Pollution: What will the States Do?",** *Science News*, **v. 101, no. 24, 10 June 1972, pp. 372-373.**

Describes the interrelatedness of urban problems and the inadequacy of the fragmented approaches, such as the present approaches to urban air pollution; discusses the possible consequences (extensive urban mass transit and banning of any fossil fuel plant construction) of a strict interpretation of a U.S. court decision, i.e., one which says that the amounts of any pollution, anywhere in the U.S., may never be increased, even if ambient air goals will not be violated.

2420. **"Ruchelshaus Announces EPA Decisions on State Plans for Air Quality Standards",** *Environmental News*, **31 May 1972, 6 pp.**

Announces the approval of implementation plans of 9 states and 3 jurisdictions, and of portions of plans of the remaining 41 states and 2 jurisdictions; the plans outline procedures and regulations for meeting the standards established by the EPA on April 30, 1971, for 6 pollutants: sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, nitrogen oxides, and hydrocarbons.

POLLUTION – NOISE

2421. **Berland, T., "Noise Pollution",** *Smithsonian*, **v. 3, no. 4, July 1972, pp. 14-19.**

Points out that noise is a threat not only to hearing, but also affects the heart, blood vessels, and eyes (makes pupils dilate), and causes changes in secretion of acids by the stomach and in the functioning of the kidneys; suggests several protective measures, such as earmuffs, earplugs, and changes in the design of walls (staggered stud walls); emphasizes that a better solution is to prevent noise at the outset; and describes legislative actions designed to control noise.

POLLUTION – PESTICIDES AND HERBICIDES

2422. **"DDT Condemned"**, *Nature*, **v. 237, no. 5356, 23 June 1972, pp. 422-423.**

Describes the debates and court actions which have finally led W. D. Ruckelshaus, EPA Administrator, to decide that "the long-range risks of continued use of DDT for use on cotton and most other crops is unacceptable and outweighs any benefits", and to place practically a total ban on the use of DDT in the U.S. after December 31, 1972; describes efforts of the Environmental Defense Fund to make the DDT ban effective immediately, and of E. M. Sweeney, the public hearing examiner, to fight the ban.

2423. **"Pesticide Economics Moving in New Directions"**, *Chemical & Engineering News*, **v. 50, no. 17, 24 April 1972, pp. 20-21.**

Reviews the discussions at the national meeting of the American Chemical Society, which focused on generating forces – ecology, economics, entomology – working to change pesticide development, production, and use; highlights of the meeting included Dow Chemical's and Union Carbide's presentation of the costs and time required for pesticide development, and the description of new insect control techniques, such as the integrated technique which combines insecticides with noninsecticidal methods and can reduce insecticide use by as much as 50%.

2424. **Maddox, J., "Pollution and Worldwide Catastrophe"**, *Nature*, **v. 236, no. 5348, 28 April 1972, pp. 433-436.**

Examines the concentrations of organochlorine pesticides in the environment on a worldwide basis; concludes that "even if the most gloomy interpretation of the data now available turns out to be correct, the result will not be a threat of worldwide catastrophe for the human race, but rather an economic question of an unusual kind – how is it possible to balance against each other the damage done to particular species of animals by the use of persistent pesticides and the benefits of their past and future use?"

POLLUTION – PROBLEMS AND CONTROL

2425. *The Economics of Clean Air*, **Annual Report of the Administrator of the Environmental Protection Agency to the Congress of the United States, February 1972, 224 pp.** (Available from Press Office, Environmental Protection Agency, Washington, D.C. 20460.)

Presents cost estimates, computed on a national level, for controlling major air pollutants from stationary sources (solid waste disposal, heating and power generation, and 17 types of industrial processes) for 1973 to 1977, and mobile sources (light- and heavy-duty road vehicles) for 1968-1977 model years; projects the aggregate price impact and describes the price model used to derive the projection.

2426. *The Economic Impact of Pollution Control: A Summary of Recent Studies*, **Prepared for the Council on Environmental Quality, Department of Commerce, and Environmental Protection Agency, March 1972, 42 pp.**

Reviews results of preliminary studies conducted to assess the economic impacts of air- and water-pollution abatement requirements on certain industrial activities, including cement manufacturing, electric power generation, iron foundry operations, nonferrous metals smelting and refining, petroleum refining, pulp and paper mills operations, and steelmaking; general indications are that the impact would not be severe, but that measurable impacts on the overall economy and on individual industries are likely.

2427. **Blogett, J., "Costing out Pollution: The State of the Art"**, *sppsg Newsletter*, **v. 3, no. 5, May 1972, pp. 1-10.**

Reviews Congressional actions to provide information on the economic impact of pollution control in 1971, including amendments by Sen. Buckley providing for "the development of comprehensive mechanisms for measuring the total social, environmental, and economic costs and benefits of human activities . . ."; presents summaries of 6 reports on the cost/benefits of pollution control (4 prepared by the EPA, the CEQ, and the National Wildlife Federation, 1 prepared for the CEQ, EPA, and Commerce Department, and 1 for the Office of Science and Technology); concludes that the results encourage a balanced view of the environment-pollution-economy situation.

2428. **"Cost Versus Benefits of Pollution Control"**, *Chemical & Engineering News*, **v. 50, no. 25, 19 June 1972, p. 9.**

Questions the benefits of complete control of pollution, citing figures which reveal the high cost of removing the last 10% of pollution; the cost per incremental % removed increases 10-fold above the 92% level; water pollution control costs skyrocket from $700 million per incremental % to achieve an 85-95% removal level to 6 billion per each additional % removed for the 95-99% level.

2429. **Hill, G., "Cost of Cleanup: Or a Myth of Factory Closings is Exploded"**, *Congressional Record*, **v. 118, no. 94, pp. S9153-S9155.** (Reprinted from *New York Times*.)

Explodes the myth that pollution-abatement regulations are "crippling substantial segments of American Industry"; presents highlights of a survey by the *New York Times*, corroborated by government reports, showing that pollution control requirements were a major factor in shutdowns in only a few cases; cumulative expenditures for pollution control by industry over a 6-year period are expected to be less than 1% of GNP; presents the pros and cons concerning the impact of pollution-control costs.

2430. **"Will the Polluter Pay?"**, *Nature*, **v. 237, no. 5351, 19 May 1972, p. 126.**

Reviews statements presented at a 1-day conference on industry and the environment which described the ineffectiveness of U.S. pollution policy as compared with that of Great Britain, and recommended international pooling of research knowledge on pollution to avoid duplication and to achieve uniform standards.

2431. **Wade, R., "The Politics of Pollution"**, *Ecology Today*, **v. 2, no. 3, July/August 1972, pp. 12, 14.**

Discusses reasons for society's unwillingness or inability to consider the costs of using and polluting resources such as air and water, and points out that there is no mechanism by which a cost can be assigned to these resources; discusses the problem of the growing demand for and increasing scarcity of clean air and water; offers two alternatives: change consumption and production patterns, or reallocate our resources – both of which are immensely difficult in the face of infinitely increasing demands.

2432. **Conine, E., "Give Up Gadgets for Ecology's Sake?"**, *Congressional Record*, **v. 118, no. 97, 15 June 1972, p. E6275.**

Offers, facetiously, an environmental-guilt rating system to test vocal environmentalists so as to emphasize the need to clear up the present hypocrisy which surrounds the ecology movement; contends that the ultimate solution lies not in stopping economic growth or power plant construction, but in the technological fix: pollution-free power, recycling of resources, outer space garbage disposal, and perhaps colonization of the planets.

2433. *Environmental Conservation*, **Prepared by the National Petroleum Council for the U.S. Department of the Interior, 1972, 406 pp.** (Available from National Petroleum Council, 1625 K Street, N.W., Washington, D.C. 20006. Price: $10.00.)

Presents the results of a comprehensive study of environmental conservation problems as they relate to or impact upon the petroleum industry; contains 10 chapters grouped under 3 parts: I. General Considerations (requirements for environmental conservation and law and regulatory policy); II. Industry Operations (fundamentals, exploration and production, refining, storage, transportation, and marketing, and major oil spills); III. Use of Industry Products (fundamentals and emissions and trends for mobile equipment and stationary plants); includes a glossary and an index.

2434. **Waldie, J., "Warning: This Planet Might be Dangerous to Your Health"**, *Congressional Record*, **v. 118, no. 57, 12 April 1972, pp. E3641-3643.**

Presents a personal assessment of the condition of the ecology in the U.S., considering air and water pollution, land management and endangered wildlife, and mineral resource shortages; suggests means for coping with environmental pollution: continued efforts to alert the public to environmental problems, more environmental legislation, and recycling.

2435. **"Confidence and Optimism"**, *Nature*, **v. 236, no. 5347, 21 April 1972, p. 364.**

Presents suggestions by Prof. D. Gabor (Imperial College, University of London and CBS laboratories, Stanford, Connecticut) on actions necessary to solve our environmental problems: (1) redirection of technology accompanied by social reforms, (2) limitation of motor cars to 50 hp, (3) imposition of a tax on internal combustion engines, (4) recycling of wastes, (5) development of substitutes for limited natural resources, and (6) the production of only biodegradable plastics.

2436. *Progress in the Prevention and Control of Air Pollution*, **Annual Report of the Administrator of the Environmental Protection to the Congress of the United States, March 1972, 17 pp.** (Available from Environmental Protection, Washington, D.C. 20460.)

Reports the principal accomplishments (during 1971) of EPA's program of air pollution research and control activities, including: development of a prototype automobile engine that meets EPA's 1976 emission standards; publication of proposed emission standards for 3 hazardous materials (asbestos, beryllium, and mercury); promulgation of new source performance standards for 5 types of industrial sources of air pollution; and publication of guidelines to assist states in developing plans to achieve the air quality standards.

2437. **Rothermel, T. W., "Environmental Management: Pitfalls and Profits"**, *Mechanical Engineering*, **v. 94, no. 6, June 1972, pp. 31-34.**

Discusses the problems faced by entrants into the environmental management business in 6 key areas: the pollution control, product, customer, market, competition, and timing areas; identifies the opportunities for profit in solving pollution problems, in documenting product capabilities, in matching customer needs, in acquiring marketing competence, in exploiting competitive intelligence, and in being ready at the right time.

2438. *Environmental Pollution & Control*, **National Technical Information Service, Weekly Government Abstracts, 1972.** (Available from U.S. Department of Commerce, National Technical Information Service, Springfield, Va. 22151. Price: $12.50/yr.)

Announces the publication of a new weekly newsletter *(Environmental Pollution & Control)* which will report on new technical developments, just-released research reports, and Federal environmental impact statements in the areas of air, noise, solid wastes, and water pollution control; publications from over 225 Federal sources will be abstracted, with the total number of abstracts per year approaching 1,500.

POLLUTION – RADIATION

2439. **Dow, J. G., "Testimony of Dr. Ernest J. Sternglass before the Joint Committee on Atomic Energy"**, *Congressional Record*, **v. 118, no. 58, 13 April 1972, pp. E3775-3776.**

Presents a statement opposing the proposed changes in licensing procedures for nuclear plants, and attesting to a direct correlation between the radioactive discharges from nuclear power plants and the increase in infant mortality rate in the surrounding areas; calls for legislation requiring public hearings at the time the operating permit is to be granted to allow maximum public participation in decisions affecting health and safety.

2440. **Schultz, V., and Whicker, F. W.**, *Ecological Aspects of the Nuclear Age: Selected Readings in Radiation Ecology*, **U.S. Atomic Energy Commission, Technical Information Center, Report TID-25978, 1972, 588 pp.** (Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22151. Price: $6.00.)

Presents a compilation of scientific literature on radiation ecology, grouped under 5 major subjects: Part I. Scope, Status and Needs of Radiation Ecology; Part II. Radionuclide Cycling; Part III. Ionizing Radiation Effects; Part IV. Ecological Techniques Utilizing Ionizing Radiation; and Part V. Nuclear War, Waste Disposal, and Peaceful Uses of Nuclear Energy; includes an appendix which lists selected bibliographies, proceedings, and books concerning radiation ecology.

2441. **Atkins, H., "Radioactive Salt Cellar",** *The Sciences,* **v. 12, no. 2, March 1972, pp. 20-22.**

Presents the reasons for the objections of the Department of Interior's Kansas Geological Survey to the AEC's plan for storing radioactive waste in salt beds at Lyons, Kansas: concerns over egress of water to the salt through the numerous oil and gas holes penetrating the burial area, over the applicability of the AEC's heat-flow analysis of salt storage to the Lyon's site, and over possible hazards should the site be disturbed by unforeseen natural or man-made events.

2442. **Hamilton, W. W., "The Unsolved Problem of Nuclear Wastes",** *Technology Review,* **v. 74, no. 5, March/April 1972, pp. 15-19.**

Describes present procedures for disposing of high-level, long-lived radioactive waste and 3 proposed concepts for waste storage: deep cavern, vulcanism, and salt mine; cites the need for further studies regarding the suitability of Lyons as a burial site; urges greater interchange of information on nuclear waste disposal between the U.S. and Germany and the establishment of an overall, well-coordinated plan for waste management by the AEC.

2443. **"AEC Decides to Store Wastes on Surface",** *Science News,* **v. 101, no. 20, 27 May 1972, p. 342.**

Announces the Atomic Energy Commission's decision to design and build surface storage facilities for commercial atomic wastes, the locations of which facilities have yet to be determined; reports that surface storage is potentially as safe as underground storage, but requires constant technical surveillance; calls attention to the AEC's plans to build a small pilot underground storage plant at a site to be selected by the U.S. Geological Survey.

2444. **Jacobsen, S., "Turning up the Gas: AEC prepares Another Nuclear Gas Stimulation Shot",** *Bulletin of the Atomic Scientists,* **v. 28, no. 5, May 1972, pp. 35-38.**

Describes concerns over the possible consequences of the AEC's proposed Project Rio Blanco to stimulate the flow of natural gas from deep impermeable rocks by nuclear explosions: accidental venting of radioactive products into the atmosphere, underground-water contamination, release of radioactive krypton-85 and tritium into the atmosphere during flaring, and contamination of other underground mineral resources; quotes a statement expressing concern over U.S. science policy, questioning the wisdom of rushing into new technologies which are not yet fully understood.

POLLUTION – WATER

2445. **Strandberg, C.,** *Water Pollution: Causes, Mechanisms, Solution,* **Milieu Information Service, Triton Building, 33 East San Fernando Street, San Jose, Calif. 95113, 1972, 150 pp.**

Contains 7 chapters describing the nature of water pollution, and its impact on recreation and aesthetics, public water supplies, fish and wildlife, agriculture, and industry; discusses possible solutions, describing as a worthy example the activities of quasi-public water supply and pollution control corporations in West Germany; describes the promise of the Earth Resources Orbiting Satellite as a means of effectively monitoring water quality.

2446. **Schwengel, F., "Agricultural Pollution Problems",** *Congressional Record,* **v. 118, no. 108, Part II, 30 June 1972, pp. E6702-6703.**

Rep. Schwengel describes the major sources of agricultural water pollution – sediment, herbicides and pesticides, fertilizers, and livestock wastes; discusses in particular the problems created by sediment and water runoff, which carries many diseases and poisonous chemicals such as DDT; describes the bill H.R. 15596, which would enable the Secretary of Agriculture to take steps to see that the

watershed program dealing with runoff problems progresses satisfactorily.

2447. **Lagnese, J. F., Jr., "Water Pollution Control Policy: A Need for Engineer Involvement"**, *Congressional Record*, **v. 118, no. 57, 12 April 1972, pp. E3593-3594. (Reprinted from** *Professional Engineer*, **March 1972.)**

Discusses the importance of the involvement of engineers in policy making procedures, emphasizing that both the problems and decisions made are of interest to the entire country and that engineers must develop the capability to effectively communicate with the public and the political institutions; suggests a plan to provide Congress with an interpretive review of all major issues relating to water pollution control.

2448. **"EPA Using Aircraft to Study Eutrophication in Lakes"**, *Environmental News*, **7 May 1972, 2 pp.**

Announces details of a plan to conduct a nationwide aerial survey of approximately 1,200 lakes, to identify bodies of water in the U.S. with potential or actual eutrophication problems brought on by the discharge of excessive amounts of phosphates into them from various sources; water samples will be collected by scientists on board pontoon-equipped planes; the final step will be to determine what percentage of the phosphate in a particular lake comes from a sewage treatment plant, and the effect of a phosphate control strategy.

POPULATION

2449. **Packwood, B., "Third Part of Report of Commission on Population Growth and the American Future"**, *Congressional Record*, **v. 118, no. 55, 10 April 1972, pp. S5703-5706.**

Presents highlights of Part III of the Commission's report [for Parts I and II see *SPR* 5(1):2009] which recommends that: (1) the U.S. plan for a stabilized population; (2) the flow of immigrants be closely regulated; (3) the Government exercise greater control over land-use planning, housing, and development; (4) the National Institutes of Health establish a National Institute of Population Sciences to implement population research; and (5) an Office of Population Growth and Distribution be established within the Executive Office of the President.

2450. **Lincoln, R., "Population and the American Future: The Commission's Final Report"**, *Family Planning Perspectives*, **v. 4, no. 2, April 1972, pp. 10-22.**

Presents a comprehensive review of the final report of the Commission on Population Growth and the American Future: summarizes the Commission's 4 basic goals and 62 of its major recommendations for policies and programs to achieve those goals, indicating, in each case, personal judgments as to whether action to implement the proposals is required by public and private institutions at the national, state or regional, or local levels.

2451. **Ehrlich, P. R., and Ehrlich, A. H.,** *Population, Resources, Environment: Issues in Human Ecology*, **2nd ed., W. H. Freeman and Company, San Francisco, Calif., 1972, 509 pp. ($9.50)**

Contains 13 chapters dealing with such topics as the extent of the population-growth crisis; population statistics; present and future demographic structure; the limits of the earth (energy, water, mineral resources, forests); food production; environmental threats to man (all types of pollution and geological hazards); the ecosystems in jeopardy; population control; and the international aspects (development, aid, politics, and controls); outlines a general course of action to ameliorate the results of the current crisis; includes 6 appendixes, a general bibliography, and an index.

2452. **Brown, P. G., "Do We Really Need a Population Policy"**, *The Hastings Center Report*, **v. 2, no. 2, April 1972, p. 7.**

Presents reasons for the continued need for a U.S. population policy in spite of the recent decline in birth rate: the decline may be short term, birth rate statistics alone will not reveal whether overpopulation still poses a threat to society, and geographical distribution as well as age structure have bearing on the population problem; suggests that present government policies are often at cross purposes and are designed without consideration of their demographic consequences.

2453. **Gilfillan, S. C., "Environmental and Population Problems Reconsidered"**, *Technological Forecasting and Social Change,* **v. 3, no. 4, 1972, pp. 403-413.**

Describes the advantages and disadvantages which arise from increased population, and examines the thesis that the larger the population of the world, the more abundant will be the supply of discoveries and inventions to meet man's needs; discusses the problems associated with educating great masses of people and supplying adequate food and housing, and describes the possibilities for the future.

2454. **Brown, H., and Hutchings, E., Jr.,** *Are Our Descendants Doomed? Technological Change and Population Growth,* **Viking Press, New York, 377 pp.** ($3.45, paperback)

Consists of 12 papers and discussions from a California Institute of Technology conference, with an Introduction and Conclusions by Harrison Brown; focuses on mankind's current complex and interrelated problems centered around rapid population growth: technological change, economic development, the resource base, the environment, religion, politics, government, and the individual desires of all human beings; concludes that "it is by no means clear that we are going to be able to extricate ourselves from the mess we are in"; indexed.

POSTAL TECHNOLOGY

2455. **Mustafa, H.,** *Postal Technology and Management,* **Lomond Systems, Inc., Mt. Airy, Maryland 21771, 1971, 240 pp.** ($15.95)

Describes and analyzes the Postal Service program to utilize technological advances in electronics and material-handling equipment in finding solutions to problems of mounting work and rising costs; investigates the implications of mechanization in terms of replanning of flow of mail, centralization of processing, new transportation modes, improved layout and building design, and increased patron cooperation; evaluates the effectiveness of the mechanization program and examines the reasons for the inadequacy of the research program.

RESOURCE MANAGEMENT

2456. *Towards a National Materials Policy: Basic Data and Issues,* **Interim Report of National Commission on Materials Policy, April 1972, 63 pp.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 65 cents.)

Discusses the Nation's materials needs and supplies, and the major issues involved in a national materials policy (domestic resources, foreign resources, Government stockpiling, manpower, and research and technology); presents brief summaries of information on the various commodities (supply and demand, reserves, recovery and recycling, and possible associated environmental problems) together with statistical tables.

SCIENCE AND THE LAW

2457. **"Technology, Law, and Politics",** *SPPSG Newsletter,* **v. 3, no. 3, March 1972, p. 12.**

Describes an interdisciplinary research program established at the University of Colorado to investigate the responses of the legal-political system to technological advances that threaten our health and environment; the study is expected to reveal possible common elements of the response mechanism and lead to recommendations on ways to promote faster and more flexible responses to such new technologies; for further information write to Frank Keith, Director, Interaction of Technology, Law, and Politics, Woodbury 303, University of Colorado, Boulder, Colorado 80302.

SCIENCE POLICY BIBLIOGRAPHIES

2458. *Index to Literature on Science of Science,* **Research Survey and Planning Organization, CSIR, v. 7, nos. 5 and 6, May and June 1971, 23 pp.** (Available from the Research Survey and Planning Organization, CSIR, Rafi Marg, New Delhi-1, India.)

Contains 100 annotated references to science policy literature published during

May through August 1970 in 24 journals (mostly Indian), listed under 12 headings, including agriculture, economic development, education, foreign collaboration, industry, management, manpower, planning, policy, and trade.

2459. *Index to Literature on Science of Science*, **Research Survey and Planning Organization, CSIR, v. 7, nos. 7 and 8, July and August 1971, 33 pp.** (Available from the Research Survey and Planning Organization, CSIR, Rafi Marg, New Delhi-1, India.)

Contains 141 annotated references to science policy literature published during September through December 1970 in 22 journals (chiefly U.S. and British), listed under approximately the same headings as listed in Ref. 2458, with the addition of automation and politics.

2460. *Current Literature on Science of Science*, **Research Survey and Planning Division, CSIR, v. 1, no. 1, January 1972, 25 pp.** (Available from the Research Survey and Planning Division, CSIR, Rafi Marg, New Delhi-1, India.)

This publication (formerly entitled *Index to Literature on Science of Science)* contains 92 annotated references to science policy literature published during 1971 in 36 journals, listed under 40 headings, including decision making, developing countries, energy, industrial policy, information processing, management of R&D, pollution, science and social change, and space research.

2461. *Current Literature on Science of Science*, **Research Survey and Planning Division, CSIR, v. 1, no. 2, February 1972, 50 pp.** (Available from the Research Survey and Planning Division, CSIR, Rafi Marg, New Delhi-1, India.)

Contains 197 annotated references to science policy literature published during 1971 in 42 journals, listed under 37 headings, including agriculture, communications, environmental improvement, industrial management, innovation, systems design, and technical progress.

SCIENCE POLICY STUDIES

2462. *Science Policy Research Unit: Annual Report for 1971*, **The University of Sussex, 1972, 56 pp.** (Available from S.P.R.U., Nuffield Building, University of Sussex, Falmer, Brighton, Sussex, BN1 9RF, England.)

Defines the term "science policy" as it has been interpreted in the work of the Unit, and briefly describes the programs being conducted in 5 principal areas: social and technological forecasting, science policy and developing countries, other international aspects of science policy (such as chemical weapons and arms control), research and innovation in industry, and historical studies of science and science policy; also summarized are the Unit's short-term projects and consultancy, and postgraduate research work.

2463. *Harvard University Program on Technology and Society, 1964-1972: A Final Review*, **1972, 285 pp.** (Available from Harvard Information Office, 1350 Massachusetts Ave., Holyoke Center, Cambridge, Mass. 02138.)

Reviews the program's research since 1964, presenting abstracts of most of the publications to date and giving extended accounts of recent work still to be published; contains an introduction by E. G. Mesthene, Director of the Program, entitled: "The Study of Technology and Society: Methods and Issues", which summarizes the principal contribution of the program and suggests a direction for future research in this area; includes 3 appendixes listing the publications generated by the program, the research personnel, and the courses given by program personnel or based on program-generated research.

2464. **Pavitt, K., Analytical Techniques in Government Science Policy", *Futures*, v. 4, no. 1, March 1972, pp. 5-12.**

Summarizes results of an OECD study on techniques of science policy used by some OECD countries; defines the characteristics of science and technology according to how they affect analytical techniques; lists detrimental consequences of using analytical techniques, as well as the positive aspects; suggests that more knowledge is needed concerning the proper relationship of analysis to decision making, and the areas in which better forecasting could play a significant role.

2465. **Amara, R. C., "Toward a Framework for National Goals and Policy Research", *Policy Sciences*, v. 3, no. 1, March 1972.**

Defines a preliminary research framework for analysis of national policy alternatives, including 5 basic elements: values, goals, attainments, strategies, and societal processes and indicators; outlines a specific research program based on this framework, and suggests other possible applications – for example, in describing the relationship of an industry to the economy, or that of a local government to the state and Federal Governments.

2466. *Science Policy: A Working Glossary*, **prepared for the House Subcommittee on Science, Research, and Development by the Science Policy Research Division, Congressional Research Service, Library of Congress, April 1972, 58 pp.** (Available from Committee on Science and Astronautics, U.S. House of Representatives, Washington, D. C. 20515.)

Presents narrative definitions of about 150 terms likely to occur in discussions of the issues of science policy; terms range from "adaptation" to "value", with such items as "backlash", "creativity", "futures research", "paradigm", "risk analysis", "stochastic process", and "technology assessment" in between; over a page is devoted to the definition of "science policy".

SCIENTIFIC INSTITUTIONS

2467. **Cortright, E. M., "Trends in Aeronautics and Space Research at the Langley Research Center"**, *Congressional Record*, **v. 118, no. 81, 18 May 1972, pp. E5477-5479.**

Discusses basic purposes of the Center and factors bearing on its future which must be assessed: the direction of present programs, future options, national needs and priorities, and NASA's probable role and Langley's part in it; aeronautical research is directed toward reduction of aircraft noise and congestion at airports, development of VTOL and STOL aircraft, and perfection of sub- and supersonic transports, while space research is focused chiefly on development of the technology to support the space shuttle, and on the application of space technology to monitoring of the earth's atmosphere, resources, and oceans.

2468. **"National Research Council Gets Overhaul"**, *Chemical & Engineering News*, **v. 50, no. 19, 8 May 1972, p. 32.**

Describes the reorganization of the National Academy of Sciences' National Research Council "to assure both the continuing strength of the national scientific efforts and the vigorous, imaginative application of science and technology in solving important problems in American society"; the reorganization will take 1 to 2 years to implement, and the new NRC will comprise 2 major categories of functional units: (1) disciplinary "assemblies", such as physical sciences, life sciences, social sciences, behavior sciences, Institute of Medicine, and the National Academy of Engineering, and (2) multidisciplinary commissions or boards for particular aspects of society, such as urban affairs, transportation, communication, information, energy, environment, agriculture, peace, education, and manpower.

2469. **"Troubles Surface at Academy Meeting"**, *Nature*, **v. 237, no. 5349, 5 May 1972, pp. 6-8.**

Reports on discussions at the Annual meeting in April of the National Academy of Sciences; describes early unsuccessful attempts to eliminate classified projects, and approval during the meeting of a resolution requiring justification and agreement before accepting such projects; presents background and plans for reorganizing the National Research Council to make it more responsive to requests for multidisciplinary studies; discusses disagreements between the NAS and the National Academy of Engineering stemming from NAS's dominance of NRC affairs, in spite of the fact that the NRC constitutes the operating arm of *both* the NAS and the NAE.

2470. *Research Institutions of the Future: AAAS Symposium*, **Acropolis Books, Prometheus Series, 2400 17th St., N.W., Washington, D. C., 1972, 164 pp. ($3.95)**

Presents a compilation of papers grouped under three categories – Social Relations of Science, The Dynamics of Institutional Change, and The Institutional System of Science; subjects covered include institutions and the generation of purpose, policy studies, the future of industrial research laboratories (Ref. 2473), sociotechnical laboratories and the future of team research (Ref. 2472), and institutional assessment.

2471. **Orlans, H.,** *The Nonprofit Research Institute: Its Origin, Operation, Problems, and Prospects,* **McGraw-Hill, New York, N. Y., 1972, 180 pp. ($6.95)**

Traces the origins of the nonprofit institutes, and describes their operations, documenting the vast range of projects carried out by at least 400 institutes, with expenditures of $1.6 billion and a staffing of about 38,000 professionals; discusses the major trends influencing the nonprofit institutions, and assesses their potential for the future, emphasizing that "they provide vital strands in the cords that link science to technology, ideas to action, and government to the public interest".

2472. **Weinberg, A. M., "Sociotechnical Institutes and the Future of Team Research",** *Prometheus,* **v. 1, no. 4, May 1972, pp. 112-133.**

Traces the origins of "big team science", and examines its interdisciplinary institutions; assesses the capacity of this team approach to launch and carry out the scientific breakthroughs so vital for the progress of science; speculates on the future of team research, describing new fields where it would be applicable (biomedical research); examines the need for redirection of the efforts of big laboratories toward solving complex social problems, and suggests the creation of national sociotechnical institutes.

2473. **Collier, D. W., "The Future of Industrial Research Laboratories",** *Prometheus,* **v. 1, no. 4, May 1972, pp. 91-99.**

Examines the pressures for change in the organization of industrial research establishments, including the rising concerns over safety of products, demands for protection of the environment, and management's demands for increased productivity; describes the typical research establishment of today, and discusses the reasons for its deficiencies in the qualities of innovativeness, productivity, and flexibility; suggests an organization form for the future – an "organization for innovation", operating within the R&D function and consisting of a multidisciplinary core (the invention part of the organization) and an innovation section.

2474. **Sknolnikoff, E. B., "Science and Technology: The Implications for International Institutions",** *International Organization,* **v. 25, no. 4, 1971, pp. 759-775. (Reprint available from Science and Public Policy Studies Group, E53-418, Massachusetts Institute of Technology, Cambridge, Mass. 02139.)**

Reviews the major effects that advances in technology have had on international relations, and identifies the likely future trends; such as intensified interdependence of societies caused by the development of certain global technologies: in communications, weather forecasting and modification, geological surveillance, direct broacasting, and others; assesses the possible impact of future technological developments in specific areas, emphasizing that the locus of decision making in many technology-related areas must move from the national to the international sphere; presents arguments in support of international control (perhaps by an international science foundation) of some aspects of science and technology.

SOCIETY – SCIENCE INTERACTION

2475. **Primack, J., and Hipple, F. von, "Scientists, Politics, and SST: A Critical Review",** *Bulletin of the Atomic Scientists,* **v. 28, no. 4, April 1972, pp. 24-30.**

Examines the circumstances leading to the initiation, continuation, and termination of the SST project and discusses the roles played by technical experts and politics in the decision-making process; describes the effectiveness of the public debate on the SST in demonstrating the weight of public opinion, and emphasizes the need (1) for greater scrutiny of government activities by "citizen professionals", (2) for lawyers to direct part of their efforts to "public interest law", and (3) for scientists to practice "public interest science and engineering".

2476. **Schultz, T. W., "The Ecosystem Doom",** *Bulletin of the Atomic Scientists,* **v. 28, no. 4, April 1972, pp. 12-17.**

Discusses modern agriculture as it relates to society and the environment; notes the ability of human beings to adjust to changing circumstances, citing specific adjustments occurring in poor countries; contends that while there are no easy solutions to food-population problems, the ecology is not doomed by them; stresses the need for advances in knowledge on the behavior of families in order to

provide them with new and better opportunities and with information such as means of birth control.

2477. **Hansen, A. G.,** *Our Future is at the Crossroads,* **Address before American Power Conference, 18 April 1972,** 7 pp. (Copies available from The University News Service, Purdue University, Lafayette, Ind. 47907.)

Purdue's President refers to challenges faced by the power industry and by higher education as illustrative of those facing the U. S. as a nation (environmental, urban, and population "crises"); attributes sluggishness of public response to the new cultural climate of rapid social change, and cautions against accepting quick solutions to complex problems "at the price of past freedoms"; calls on the universities to see that students get needed grounding in economic and political theory, value structures, and technology, and to apply their expertise "to the complex problems of our technological society", setting clear priorities for support and acting upon them.

2478. **Hughes, H. E., "Synthesize to Survive",** *Astronautics & Aeronautics,* **v. 10, no. 5, May 1972,** pp. 20-23.

Describes changing public attitudes toward U.S. national defense, foreign military threats, defense spending, and science and technology, and our society's basic goals; emphasizes that "the technical community needs to recognize that our society can disintegrate if we continue to neglect our priority domestic needs – we must shape a new security in terms of our modern industrial technology".

2479. **Kaysen, C., "The Computer that Printed Out W*O*L*F*",** *Foreign Affairs,* **v. 50, no. 4, July 1972,** pp. 660-668.

Analyzes the book, *The Limits to Growth,* [*SPR* 5(1):186], which combines the skills of a computer, system dynamics, and the endorsement of the Club of Rome to support its conclusion that if society does not promptly reorganize its fundamental institutions, it will be faced with an unmanageable crisis; contends that the book is "gravely deficient" and possesses "unwarranted" conclusions, pointing out flaws in the "Limits" analysis; cites population growth, pollution, and deleterious side effects of technical change as problems requiring sustained, self-conscious efforts to correct; suggests that society's problem is to "find a set of supplementary adjustment mechanisms and incentive systems which can guide the relevant actors to socially more desirable choices", concludes that the practice of "crying Wolf" is "indispensible", since humans are moved more by passion than by reason.

2480. **"Physics and the Quality of Life",** *Nature,* **v. 236, no. 5346, 14 April 1972,** pp. 317-319.

Examines the difficulties posed by a proposed amendment to the constitution of the American Physical Society which would require the society to organize its activities so as to increase man's understanding of nature, contribute to the enhancement of the quality of life, and shun activities judged potentially harmful to the welfare of mankind: the difficulties of determining the potential benefits of new scientific developments of knowing what constitutes the quality of life, and of knowing with certainty whether the seemingly most threatening aspects will actually turn out to be harmful; poses questions as to how the third requirement would be enforced and who would determine the activities to be avoided.

2481. **Dickson, D., "Science to Help the People",** *New Scientist,* **v. 54, no. 794, 4 May 1972,** pp. 277-278.

Describes the interaction between science and society, emphasizing the need for both the academic community and the public to play major roles in the determination of science policy; examines possible functions of the proposed Community Science Research Councils, which would be organized on a regional or local basis and whose main role would be to provide scientific knowledge and technical expertise to those minority and underrepresented groups in the community whose needs are currently unacknowledged or unfulfilled by existing institutions.

2482. **Flowers, Sir B., FRS,** *Technology and Man,* **the First Leverhulme Memorial lecture, Liverpool University Press, 1972,** 29 pp. (Available from Registrar, The University of Liverpool, Senate House, Abercromby Square, P.O. Box 147, Liverpool L 69 3BX, England.)

Describes science as a "cultural activity" – a means for man to understand and relate to his world – that is also basic to industry, while technology is what is done by scientific methods; explores the influences bearing on science, including the aims of society; stresses the importance of the social and biological sciences, predicting that by 1990 life scientists may outnumber physical scientists; delves into population, resources, and energy supplies, and the interaction of man with his resources and with his machines; concludes that education should be general, not geared to today's problems, because tomorrows will differ greatly and be vastly more complex.

2483. **Knelman, F. H., "Relevant Science, or the Scientist as Revolutionary"**, *Science Forum*, **v. 5, no. 3, June 1972, pp. 8-9.**

Discusses the role of "relevant science" in modern society, which involves recognition that "Big Science" and modern technology are basically social in character; suggests that scientists form new associations, not necessarily along traditional lines for the purposes of relevant science; notes that a model has already emerged within the environmental movement, which involves the establishment of objectives, policies, and programs, and which includes an information processing and communicating system, obveating the need for scientists to be in the same location; such an association could help to prevent abuses and misuses of science.

2484. **Gabor, D., "Technology Autonomous"**, *New Scientist*, **v. 54, no. 797, 25 May 1972, pp. 448-449.**

Stresses the importance of redirecting "autonomous technology" (i.e., technology for its own sake) into new channels useful to society; contends that consumer society is overloaded with useless and wasteful technology; describes the SST defeat as a right decision for wrong reasons, since it was brought about by an environmental lobby, and not through a determination to stop runaway development of increasingly larger and faster planes; warns that society must dominate technology or run the risk of stagnation and collapse.

2485. **Lasch, C., "Birth, Death and Technology: The Limits of Cultural Laissez-Faire"**, *The Hastings Center Report*, **v. 2, no. 3, June 1972, pp. 1-4.**

Traces the historical relationship of technology and liberal individualism in America; notes that in the absence of any public policy dealing with procreation, scientists continue to experiment in these areas, although they display less enthusiasm than the public for advancement into (or interference with) birth processes, and death processes as well; cites views expressed by J. D. Watson, Nobel-prize-winning biologist, who urges that the public conduct searching discussions of these issues instead of leaving them solely in the hands of scientists; concludes that a thorough critique of liberalism is necessary for a successful rebellion against the domination of social life by technology.

2486. **Bevan, W., "The Welfare of Science in an Era of Change: Or, Can Humpty Dumpty get it All Together?"**, *Science*, **v. 176, no. 4038, 2 June 1972, pp. 990-996.**

Discusses the principal bases of society's present disenchantment with science: (1) scientists' failure to make a commitment to public accountability; (2) the exclusion from the "world" of the scientific community of such matter as public concern and welfare; and (3) the exclusion of the public from judgments or information about scientific and technical developments that may have direct bearing on their lives, world, and future; suggests several remedial actions: political strategies, broadly defined; both short- and long-range educational programs; and the stimulation of a more clearly articulated national science policy.

2487. **Kiefer, D. M., "National Goals Prove an Elusive Target"**, *Chemical & Engineering News*, **v. 50, no. 19, 8 May 1972, p.**

Reports on a 3-day workshop sponsored by the Systems, Man, and Cybernetics Society of the Institute of Electrical and Electronics Engineers, where a group of social and physical scientists met to discuss questions related to the role of science and technology in establishing national goals; presents mixed views concerning the feasibility of seeking or setting goals; the sole conclusion was that there is an urgent need to define social patterns and encourage social experiments, to explore "the science of complexity", and to form a "new paradigm" involving a new definition of man and focused more on ethics and morality than on technology.

2488. **Weisskopf, V. F., "The Significance of Science"**, *Science*, **v. 176, no. 4031, 14 April 1972, pp. 138-146.**

Examines the conflicting views of the role of science in the human society which exist today; describes the practical applications that have evolved from basic scientific research and discusses the importance of basic science in solving today's problems, the need to recognize the limitations of science, and the obligations of the scientist in controlling the uses and abuses of science-based technology and in popularizing science through education.

2489. **Weinberg, A. M., "Science and Trans-Science"**, *Minerva*, **v. 10, no. 2, April 1972, pp. 209-222.**

Defines trans-scientific questions as those which cannot be fully answered by science, citing as examples questions on biological effects of low-level radiation exposure, on probability of improbable events, and on future behavior of a particular individual; describes the responsibilities of scientists in debates on trans-scientific questions, the advantages and disadvantages of conducting public debates, and the implications of the public's intrusion in these debates for the scientific community.

2490. **Gershinowitz, H., "Applied Research for the Public Good – A Suggestion"**, *Science* **v. 176, no. 4033, 28 April 1972, pp. 380-386.**

Analyzes the processes involved in the application of research (innovation), emphasizing the need for interaction between researchers and the users of research; describes the complexity of social problems, and suggests that techniques developed for the application of research to technology could be used in applying research to social problems; describes types of organizational structures likely to be most suitable for experimentation in social innovation.

2491. **Anderson, R., "Science and Engineering"**, *Vital Speeches of the Day*, **v. 38, no. 14, 1 May 1972, pp. 420-421.**

Points out past contributions of scientists and engineers to development of the U.S. and their importance and potential for solving present social and environmental problems; emphasizes the need for technology transfer, and describes the promise of the space shuttle for pollution detection, weather forecasting, more economical means of communication, better manufacturing and management techniques, and improved consumer products.

SPACE – EARTH RESOURCES SATELLITES

2492. *Remote Sensing of Earth Resources*, **A Compilation of Papers Prepared for The 13th Meeting of the Panel on Science and Technology, Committee on Science and Astronautics, U.S. House of Representatives, 1972, 224 pp.** (Available from U.S. Government Printing Office, Washington, D. C. 20402. Price: $1.25.)

Presents 16 papers dealing with all aspects of the remote sensing technique: its potential, specific areas in need of further development, present capabilities and state of technology, the implications for underdeveloped nations, future requirements, data handling and processing, and future applications.

SPACE – INTERNATIONAL COOPERATION

2493. **"Deadline Nearing for Europe to Participate in Shuttle Program"**, *Aviation Week & Space Technology*, **v. 96, no. 22, 29 May 1972, p. 19.**

Describes European space officials' efforts to finalize negotiations with the U.S. in order to meet the deadline for a go-no go decision on European participation in the space-shuttle system; presents the views of European aerospace executives voiced at the U.S.-European Eurospace conference in San Francisco regarding the experience and capability of European companies in specific areas of space-shuttle work, particularly on the tug.

2494. **Valentine, B., "Obstacles to Space Cooperation: Europe and the Post-Apollo Experience"**, *Research Policy*, **v. 1, no. 2, April 1972, pp. 104-121.**

Outlines the factors to be considered in arranging for European participation, in the U.S. post-Apollo space effort: (1) the differing attitudes and objectives of the

major nations of Western Europe toward space research; (2) suspicion of American motives; (3) concern about continued support for the space program within the U.S.; (4) the limited resources applied to space research within Europe; (5) the desire of some nations to develop a launch capability independent from the U.S.; and (6) dissatisfaction with American dominance of Intelsat.

2495. **"U.S.-U.S.S.R. Agreement on Space"**, *Weekly Compilation of Presidential Documents*, **v.8, no. 23, 5 June 1972, pp. 920-921.**

Comprises 6 articles designed to instigate the development of cooperation in the fields of space meteorology; study of the natural environment; exploration of near earth space, the moon and the planets; and space biology and medicine; further, in particular, the two countries will cooperate to take all measures to encourage and achieve fulfillment of the Summary of Results Discussion on Space Cooperation Between the U.S. National Aeronautics and Space Administration and the Academy of Sciences of the U.S.S.R. dated 21 January 1972.

2496. **Strickland, Z., "Joint Space Plans Confirmed at Summit"**, *Aviation Week & Space Technology*, **v. 96, no. 22, 29 May 1972, pp. 17-18.**

Describes the almost final plans for the U.S.-Soviet manned orbital space flight, as well as the spacecraft and systems to be used by both countries; lists 5 objectives of the mission, which include testing of a compatible rendezvous system in orbit and development of experience for the conduct of joint flights, including aid in emergency situations.

2497. **Maddox, B., "Intelsat – Lament for a Lost Hope"**, *New Scientist*, **v. 54, no. 798, 1 June 1972, pp. 482-486.**

Discusses the problems surrounding Intelsat, the apparently insoluble differences between American and European attitudes, and the conflicting goals set for Intelsat at the outset; the major difficulties include the relegation of developing countries to a minor position in satellite communication; traffic-formula ranking, which made Intelsat unattractive to Russia; arguments over approvals of satellite-building contracts; and arguments over management and the role of national governments; points out that Intelsat, by its commercial orientation and American dominance, has encouraged the proliferation of other satellite systems and created the real possibility of future international disputes over position in the synchronous orbit.

2498. **"Onward with Europa"**, *Nature*, **v. 237, no. 5356, 23 June 1972, p. 420.**

Discusses the European Launcher Development Organization Council's decision to continue funding the Europa launcher program despite the failure of the F11 launch in the Europa II series; presents tentative dates and costs for the remaining Europa launches through F18 and comments on the $470 million Europa III launcher, whose fate is being decided by the ELDO ministers.

2499. **Slotkin, A. L., "ESRO Ponders an Uncertain Future"**, *Astronautics & Aeronautics*, **v. 10, no. 5, May 1972, pp. 15-16.**

Discusses possible future courses for the European Space Research Organization, now that member countries are taking over ESRO's sounding-rocket program and its scientific satellite program is being phased out; examines the implications of the changeover in national priorities from basic to applied science, and describes ESRO's efforts to gain public acceptance of a proposed $100-million applications program, now awaiting approval by the member countries.

2500. **"Interlocked: Disarmament and Development"**, *Center Report*, **April 1972, pp. 3-5.**

Presents an abridgement of a draft proposal for an International Earth Resource Management Organization (IERMO), by E. M. Borgese, presented at a February 1972 Conference at the Center of the Study of Domestic Institutions; the main activities envisioned for IERMO are: operation of a satellite system; establishment of a scientific institute to assemble, analyze, and interpret data obtained by the satellite system and to train experts in such work; and establishment of a Planning Board which will use the data provided by the Institute for the global planning of resource use, recycling, and conservation.

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SPACE – PROGRAMS AND GOALS

2501. **Cowen, R. C., "Can We Look at Space Realistically?",** *Technology Review,* **v. 74, no. 6, May 1972, pp. 6-7.**

Compares the differing attitudes of Americans and the Soviets toward space programs, that is, the continuing strong commitment of the Soviets to a program that will make space development pay off in practical civilian and military applications, as contrasted to the lack of a clear national purpose which marks the U.S. space program; urges that the U.S. develop a program in terms of its own opportunities and needs to use effectively the space-flight capacity it has already acquired.

2502. **Smith, A., "How the Space Farers Fare: A British View of American and Russian Programs Since Apollo 11",** *Bulletin of the Atomic Scientists,* **v. 28, no. 4, April 1972, pp. 18-23, 26.**

Compares U.S. and Soviet space programs and spacecraft, both manned (Soyuz and Gemini) and unmanned (Intelsat communications satellites and Molniya 1 and 2); notes the secrecy surrounding Soviet space activities, chiefly to conceal failures, and the difficulties this might pose for the suggested Soviet-U.S. joint manned spacecraft mission; describes fields in which U.S. technology is superior, but suggests that the greater priority and support given to the Soviet program might enable that country to close the gap.

2503. *Astronomy and Astrophysics for the 1970's, Volume I,* **prepared for National Academy of Sciences, 1972.** (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D. C. 20418, Price: $4.75.)

Outlines the high-priority elements of a research and facility program ($844 million over the next decade), designed to utilize new technology to determine whether intelligent life exists elsewhere in the universe: the Very Large Array and Large Space Telescope (for which funding has already been approved), an optical program to upgrade existing telescopes and creation of new large telescopes, a program for X-ray and gamma-ray astronomy from orbiting observatories, a significant increase in support and development of the infrared astronomy field, and construction of an antenna with a very large millimeter wavelength.

2504. **"Interview with Olin 'Tiger' Teague",** *Congressional Record,* **v. 118, no. 50, 30 March 1972, pp. E3348-3350.**

Rep. Teague discusses changing attitudes toward space research, national priorities, benefits derived from space technology, adverse consequences of great spending cuts for space, the future of the military in space, and the future of space development, particularly the space shuttle.

SPACE – SHUTTLE

2505. **"A Successful Launching",** *Nature,* **v. 237, no. 5351, 19 May 1972, p. 129.**

Announces approval by Congress of the authorization bill for the National Aeronautics and Space Administration to fund development of the space-shuttle system; presents cost estimates advanced by the Federation of American Scientists which are in disagreement with those advanced by NASA, and describes the Federation's questions concerning the intended use of the shuttle – for civilian applications or in military programs.

2506. **"Space Shuttle: the Goldplated Delivery Limousine",** *Science & Government Report,* **v. 2, no. 7, 1 June 1972, pp. 1, 4.**

Presents testimony for and against the space shuttle given prior to the appropriation of $227 million by the U.S. Senate; notes the discrepancies between cost estimates presented by Mathematica, Inc. and those presented by freelance physicist Dr. Lapp, which Lapp contended were due to Mathematica's failure to add in all the costs; a later analysis prepared for the American Federation of Scientists confirmed Lapp's estimates (citing greater cost effectiveness of expendable boosters) and suggested that the DOD carry at least half the development costs, since the military benefits are expected to be greater than the civilian benefits.

2507. **Brooke, E. W., "The Space Shuttle"**, *Congressional Record*, **v. 118, no. 53, 6 April 1972, pp. S5505-5508.**

Sen. Brooke contends that the "space shuttle represents the most efficient means of continuing the space program at minimum cost and maximum benefit"; presents an article by R. Jastrow and H. E. Newell analyzing the shuttle program (including a short history of the U.S. space program) and commenting on the economic practicality and potential scientific benefits from the shuttle.

2508. **Driscoll, E., "The Story of an Evolving Shuttle"**, *Science News*, **v. 101, no. 14, 1 April 1972, pp. 220-221.**

Describes the changeover in basic concepts of the space shuttle resulting from studies on use rate and cost effectiveness of various design configurations; new concepts include a solid rocket booster, a part-throw-away/part-reusable system, and a system that can be used by commercial and military customers alike; discusses the new satellite design philosophy under which launch costs are considered as "the least sensitive element", noting that payload savings analyses have not as yet been completely evaluated.

2509. **Esch, M. L., "Space Exploration"**, *Congressional Record*, **v. 118, no. 48, 28 March 1972, pp. H2663-2664.**

Emphasizes the importance of continuing the space program, particularly the space shuttle; discusses nine areas where space technology can contribute to humanity, including communications, earth resources, and pollution control.

STATE AND LOCAL SCIENCE ACTIVITIES

2510. *Power to the States: Mobilizing Public Technology*, **The Council of State Governments, 1972.** (Available from The Council of State Governments, Iron Works Pike, Lexington, Ky. 40505. Price: $5.00.)

Charges that technology transfer from defense and space programs has been largely ineffective, and that huge outlays of Federal science funds support national programs but contribute little to state and local problem solving; recommends (1) that the National Science Foundation create a special task force composed of state, local, Federal, and industry representatives, which would select 3 categories of state problems for a 1-year trial run in 3 to 6 target states; (2) that panels of state and local government representatives be established in all Federal agencies concerned with domestic problems; and (3) that state university resources be brought "to bear in a more responsive and timely way on the needs and dilemmas of state governments".

2511. *Public Technology, A Tool for Solving National Problems*, **Federal Council for Science and Technology, 1972.** (Available from Federal Council for Science and Technology, Executive Office of the President, Washington, D.C.)

Describes the state and local governments' lack of resources to fill the need for public technology by themselves; offers recommendations for improving state and local government use of science and technology, which include providing for greater consultation with these governments, identifying federal R&D useful to them, and creating mechanisms to improve dissemination of science and technology.

TECHNOLOGICAL INNOVATION

2512. **"Why Industrial Innovations Fail"**, *Science Policy*, **v. 1, no. 2, March/April 1972, p. 3.4.**

Presents the major findings given in a report on the SAPPHO project (available from the Centre for the Study of Industrial Innovation, 162 Regent Street, London W1R 6DD, Price: 75p.): (1) Innovations fail because of failure to apply well-known priciples of innovation management, and (2) beliefs in "single factor" explanations of innovative success receive little support; the study revealed that successful innovating firms displayed a better grasp of user needs, performed technical development more thoroughly, and made more use of outside scientific and technical advice.

2513. **"Magruder's Mouse Emergent"**, *Nature*, **v. 236, no. 5344, 31 March 1972, pp. 190-191.**
Discusses failure of Magruder's attempts to develop a program to stimulate industrial innovation and to direct the efforts toward social and economic problems; reflects on Nixon's Science and Technology Message and how the Department of Commerce will fare as "the cornerstone of America's intervention in private industry"; notes that the U.S. may find it difficult to stimulate industrial R&D in the absence of large government funded development contracts like those prior to the cutbacks in defense and space research, and expresses doubt that the National Science Foundation's efforts will do much to foster industrial innovation either.

2514. **"Justice Stands Firm on Collaborative R&D"**, *Chemical & Engineering News*, **v. 50, no. 19, 8 May 1972, p. 21.**
Calls attention to the Justice Department's intent to continue enforcing antitrust statutes limiting collaborative R&D efforts by industry, in spite of hints to the contrary in the President's R&D message; at the April hearings before the House Subcommittee on Science, Research, and Development on the interactions of science technology with the economy, Justice contended that "competition, not collaboration, is the best way to stimulate innovation"; also it was brought out that Japan encourages R&D collaboration and grants industry subsidies and special loans and tax benefits for R&D to promote innovation in technology-intensive industries – measures which have contributed substantially to Japan's phenomenal economic growth.

2515. **"Ludwig Rebenfeld"**, *Chemical & Engineering News*, **v. 50, no. 23, 5 June 1972, p. 70.**
Presents an interview with Dr. L. Rebenfeld, President of the Textile Research Institute in Princeton, N. J., and a strong advocate of Government support of industrial R&D as a source of the background scientific information needed to stimulate technological innovation; Dr. Rebenfeld suggests that TRI's role for the textile and fiber industry might well serve as a model for cooperative industrial research and planning efforts in other industries; recommends cooperative institutionalized programs to generate basic knowledge, and proprietary efforts by industry on the application of this knowledge to the development of new technologies.

2516. **Martino, J. P., "The Pace of Technological Change"**, *The Futurist*, **April 1972, pp. 70-72.**
Discusses research into the rate of technological change to determine the time lapse from invention to application; observes that adoption is highly influenced by profitability and size of investment required; concludes that rate of technological change in recent years is increasing at a slower rate and possibly even slowing down; raises questions concerning the optimum rate of technological progress, whether the rate should be retarded in some areas and speeded up in others, and how technology can be guided to meet the needs of society.

2517. **Lessing, L., "Why the U.S. Lags in Technology"**, *Fortune*, **v. 85, no. 4, April 1972, pp. 69-150.**
Discusses a number of analyses of U.S. R&D and other information in an attempt to determine why, even though the U.S. has spent unprecedented amounts of money on industrial research, its world leadership in developing new technologies is being severely jeopardized; discusses a conclusion that the U.S. has had a meager payoff from industrial R&D because it is actually *under*investing in industrial R&D, most of the federal R&D funds having been allocated to the military and space efforts; contends that nonproductiveness is also resulting because the big industrial laboratory has been more concerned with development than with creativity; considers specifically the environmental dilemma and energy policy; describes reasons for slowdowns of technological development in satellite communications and transportation.

2518. **"With Eyes on Japan"**, *Nature*, **v. 237, no. 5354, 9 June 1972, p. 304.**
Reports some highlights of a U.K. conference on industrial innovation held in June; one speaker suggested that Britain learn from Japan about how to obtain suitable benefits from R&D investment; discusses Japan's emphasis on socially oriented research and on products for immediate economic development; attributes difficulties to too much emphasis on invention and not enough on investment;

another speaker compared the innovative records of small and large companies, noting that the latter (over 1000 employees) produced 90% of the 1100 postwar innovations studied.

TECHNOLOGY ASSESSMENT

2519. **"NATO Advanced Study Institute (ASI)"**, *sppsg Newsletter*, **v. 3, no. 3, March 1972, pp. 20-21.**

Announces the ASI to be held 18-29 September, 1972, at Lake Garda, Milan, Italy, for the purpose of exchanging experiences in methodology, institutionalization, and implementation of technology assessment, through lectures and workshops.

2520. **"Congress Moves on Technology Assessment"**, *Science Forum*, **v. 5, no. 3, June 1972, pp. 25-26.**

Discusses the impending bill to establish an Office of Technological Assessment (OTA) to evaluate new technologies and their impact on society, and provide this information to Congress as a decision-making aid; predicts that while assessors will have difficulties in being accepted on Capitol Hill, the precedent for technology assessment was established by the requirement for impact statements embodied in the National Environmental Policy Act.

2521. **"Chances Fade for Technology Assessment Office"**, *Chemical & Engineering News*, **v. 50, no. 21, 22 May 1972, p. 9.**

Describes the chief obstacle to Congressional passage of legislation to establish an Office of Technology Assessment this year – the delay caused by the Senate Subcommittee on Computerization's consideration of 3 or 4 variations of a House-passed bill, with few Senators pressing subcommittee action, and others arguing over whether OTA should be a nonpolitical independent assessor for Congress, watered down to the status of a joint committee, or placed under an existing joint committee.

TECHNOLOGY TRANSFER

2522. **Hawthorne, E. P.**, *The Transfer of Technology*, **Organisation for Economic Co-operation and Development, Paris, 1971, 150 pp.** (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006. Price: $3.25.)

Summarizes recommendations of participants from Greece, Portugal, Spain, Turkey, and Yugoslavia at the Istanbul Seminar (5-9 October 1970) concerning the formulation and implementation of government policies for technology transfer, education and training, and improvements in information and in the terms of transfer; contains 10 chapters covering such subjects as the relation between industrial development and technology transfer, the role of R&D, financing and planning for technology transfer, and the influence of institutional mechanisms; includes 74 references.

2523. **"A New Catalyst for Technology Transfer"**, *Technology Review*, **v. 74, no. 7, June 1972, p. 67.**

Outlines the specific goals of the M.I.T. Development Foundation, Inc., namely: (1) to develop a better understanding of how science and technology are applied and study innovative management systems for improving such applications; (2) to seek funds from those interested in technology transfer and in generation of new, technically based business enterprises; (3) to promote public and industrial applications of developments by the M.I.T. community; (4) to serve as a communications link between M.I.T. and government, industry, or venture capital sources; and (5) to help the M.I.T. community exploit commercial applications of technology.

2524. **Kyger, J. A., and Barton, R. S., "Think Tank Spurs Idle Ideas to Action"**, *Industry*, **March 1972** (Reprint).

Announces the establishment of Massachusetts Technology Exchange, funded by NSF, designed to pinpoint new, unused technical ideas from one firm and transfer them through licensing agreements or other arrangements to firms better able to

exploit them immediately, thus creating new products and job opportunities; part of the program will involve training or retraining Vietnam veterans and unemployed engineers; the Exchange will operate through direct contacts between firms, specialized workshops, and larger state-wide symposia.

2525. **"Senate Unit Delays Technology Conversion Bill for Comments"**, *Aviation Week & Space Technology*, **v. 96, no. 16, 17 April 1972, p. 13.**

Describes provisions of a bill designed to utilize the skills of aerospace and defense personnel for civilian programs: a total appropriation, over a 3-year period, of $1.8 billion, with $50 million to advance the state of the art in priority research areas as identified by the National Science Foundation, $1.2 billion to design technological systems that could provide improved public services, and $550 million to aid state and local governments, communities, companies, and individual engineers to make the transition to civilian programs.

2526. **"EPA Program Transfers Technology"**, *Environmental Science & Technology*, **v. 6, no. 4, April 1972, pp. 314-315.**

Describes the work performed under the Environmental Protection Agency's technology-transfer (TT) program which is primarily aimed at marketing the products (such as videotapes and design seminars and manuals) of Federal research, development, and demonstration activities; future plans include expansion of the program to include environmental areas other than waste water treatment, e.g., air, industrial waste water, and solid waste.

2527. **"More Doers Needed in Technology Transfer"**, *Chemical & Engineering News*, **v. 50, no. 25, 19 June 1972, p. 4.**

Describes activities at a June National Symposium on Technology Transfer in Washington, D. C.; some ideas expressed were that technology transfer has always had a surplus of advocates but a shortage of doers, that it is time for the doers to emerge so that return from the investment in technology, research, and development may be increased, and that Government agencies should package their available technology in more usable form for other civilian agencies, considers Japan's use of technology transfer as a model for the U.S.

2528. **Schaefer, V. J., "It's a Good 2 Cents Worth"**, *Congressional Record*, **v. 118, no. 101, 21 June 1972, p. 6383** (Reprinted from the Winona, Minnesota *Courier*, 9 June 1972).

Describes the principal benefits derived from the space program: increased accuracy in weather forecasting, advances in medicine through the use of electronics, and better monitoring of earth and ocean resources, emphasizing that the conduct of this program requires only about 2 cents out of each tax dollar; compares the funding for social programs ($100 billion) with that for the space program ($3.2 billion), citing the notable lack of accomplishment in the social areas.

2529. **Hudock, R. P., "The Crux of Saving the Cities"**, *Astronautics & Aeronautics*, **v. 10, no. 5, May 1972, pp. 10-11.**

Discusses the actions that must be taken to assure the success of domestic programs, stressing the need to abandon the trial-and-error approach and adopt the technique used in the space program - comprehensive analysis, experimentation, and testing; recommends Government financial support of social priorities at a level commensurate with that for defense and space programs; describes activities of Public Technology, Inc., a nonprofit corporation, which promotes the development of improved products and services via modern technology and scientific knowhow.

TRANSPORTATION

2530. *Urban Transportation Research and Development*, **Committee on Transportation, National Academy of Engineering, 1972, 68 pp.** (Available from Committee on Transportation, National Academy of Engineering, 2101 Constitution Ave., N.W., Washington, D. C. Price: $2.00.)

Presents recommendations of the NAE Committee on Transportation as to the types of R&D programs requiring greater financial support by the Federal Government; actions recommended include: (1) an increase in the number and size of demonstration programs on demand-responsive public transportation systems and

on off-street parking tied into existing or planned systems, (2) development and demonstration of area traffic control and other network traffic engineering techniques, and (3) large-scale institutional rearrangements designed to affect significantly the transport-usage pattern, such as staggered working hours, peak-hour auto-use taxes, and exclusion of auto movements in high-density areas.

2531. **Gilluly, R. H., "Urban Transport: Attitudes are Changing"**, *Science News*, **v. 101, no. 21, 20 May 1972, pp. 332-333.**

Describes increased support for development of a suitable urban mass transit system, by such notables as DOT head J. Volpe, EPA Administrator W. D. Ruckelshaus, and CEQ Chairman A. Train who propose to obtain funds for urban mass transit from the Highway Trust Fund; presents recommendations of a National Academy of Engineering study on urban mass transit, which include placing new housing close to employment sites to reduce commuting needs, and providing high-quality public mass transit to all areas of the urban community.

2532. **Reiff, G. A., "HSGTC – Moving toward a New Frontier in Transurface Technology"**, *Congressional Record*, **v. 118, no. 59, 17 April 1972, pp. S6183-6185.**

Describes the research and test facilities available at the U.S. Department of Transportation High Speed Ground Test Center (HSGTC), and the projects presently in progress; future projects scheduled include development and test of the Linear Induction Motor Research Vehicle and the Tracked Air Cushion Research Vehicle.

2533. *Railroad-Highway Safety, Part I: A Comprehensive Statement of the Problem*, **Report to Congress from the U.S. Department of Transportation, November 1971, 127 pp.** (Available from Federal Railroad Administration, U.S. Department of Transportation, Washington, D.C. 20590.)

Reviews in detail the complex problem of highway grade-crossing hazards, with information on research projects, warning systems, trains, drivers, and other aspects; recommendations for future specific actions are to be submitted to Congress at a later date.

2534. **"Concorde Economics"**, *Nature*, **v. 236, no. 5347, 21 April 1972, pp. 362-363.**

Discusses the problems facing the French and British Governments in connection with the SST, chiefly in finding buyers for the planes, in obtaining permission for flights over certain countries, especially the U.S., and in establishing an international airline that would fly only supersonic transports.

2535. **Talbert, A. E., "Second Thoughts – The U.S. Supersonic Supergoof", v. 118, no. 89, 2 June 1972, pp. E5948-5940** (reprinted from *New York Sunday News*, 8 May 1972).

Examines the dire consequences of cancellation of the SST program in the U.S. which include: blocking the creation of important sources of revenue which could have been applied to social needs; giving Britain, France, and the Soviet Union a 10-year lead over the U.S. in this crucial field of future development; and costing U.S. industry an estimated 500,000 jobs; points out that much of the testimony against the SST was given by persons not in the field about which they were testifying (economics professors discussing the technical design aspects and political scientists discussing environmental considerations), while qualified experts gave testimony refuting arguments concerning noise pollution, airport congestion, and the sonic boom.

2536. *Aviation Forecasts, Fiscal Years 1972-1983*, **Department of Transportation, Federal Aviation Division, September 1971, 47 pp.** (Available from Federal Aviation Administration, TAD 484.3, 800 Independence Ave., S.W., Washington, D. C. 20591).

Predicts tripling of the number of passenger enplanements and passenger miles by Fiscal 1973, and approximately 60% growth in the general aviation fleet; forecasts a sharp drop in air carrier transport production during Fiscal 1972, with the 1971 production level not to be reached again until 1978.

2537. **Anderton, D. A.,** *Aeronautics: Space in the Seventies*, **National Aeronautics and Space Administration, December 1971, 24 pp.** (Available from U.S. Government Printing Office, Washington, D. C. 20402. Price: 75 cents.)

Defines aeronautical research, and describes basic techniques used by NASA in conducting this research; briefly describes NASA's planned programs for the

1970's directed toward such goals as reduction of aircraft noise and the sonic boom; further development of vertical takeoff and landing (VTOL) aircraft; improved design of wing flaps for greater safety; solution to the problem of skidding on wet runways, which is also applicable to highways; and development of new transportation concepts.

2538. **"ICAO Aerosat Plan Gets Airline Support"**, *Aviation Week & Space Technology*, v. 96, no. 20, 15 May 1972, p. 40.

Discusses the significance of the tentative endorsement by the International Air Transport Association of an "austere" initial transoceanic air traffic control satellite (aerosat) program which would be used solely for experimentation and operational evaluation, as recommended by the International Civil Aviation Organization at its last meeting in Montreal; discusses what the modest phase I aerosat plan means to the Federal Aviation Administration and European Space Research Organization agreements, and how it might affect the White House Office of Telecommunications Policy's insistence that the U.S. portion of any aerosat system be owned and operated by a commercial company.

UNITED KINGDOM

2539. **Rosenhead, J., "The BSSRS: Three Years On"**, *New Scientist*, v. 54, no. 792, 20 April 1972, pp. 134-136.

Summarizes the major activities of the British Society for Social Responsibility in Science during the 3 years since it was formed, and presents 4 propositions to which the Society subscribes: that (1) the Society should undertake, as a priority, the provision of scientific expertise and advice to those groups in society which do not normally have access to it, (2) should continue to comment on current political issues, and (3) should continue the current ideological debate, and (4) that particular groups within the Society should not be restricted by this consensus, but only by the Society's constitution.

2540. **Fishlock, D. (Ed.)**, *The New Scientists*, **Oxford University Press, London, England, 1971, 98 pp. ($3.00)**

Contains 6 chapters by research managers in Britain recounting their efforts to steer research into more productive channels: 1. How the Atom Paid Off; 2. Creativity and the Central Laboratory; 3. The Synthesis of Ideas; 4. Harwell Changes Course; 5. Defense Research Under Pressure; and 6. Management Science and Government.

2541. **Pierre, A. J., "The Future of Britain's Nuclear Force"**, *New Scientist*, v. 54, no. 792, 20 April 1972, pp. 128-130.

Discusses the implications of the U.S.-U.S.S.R. Strategic Arms Limitations Treaty for lesser nuclear powers like Britain and France, e.g., extension of the life of the present generation of British and French ballistic-missile-firing submarines; describes three possible options for Britain in developing its nuclear force: technical autonomy, a nuclear-technology-exchange agreement with France, or continued reliance upon assistance from the U.S.

2542. **"Critical Time for Nuclear Power"**, *Nature*, v. 236, no. 5345, 7 April 1972, p. 254.

Discusses possible results of a decision concerning the future of Britain's nuclear power program, which will be based on an unpublished departmental inquiry report intended to advise ministers on which type of reactor Britain should adopt to fill the gap between advanced gas-cooled reactors, which are not yet operational, and breeder reactors which are expected to start generating power in the 1980's; presents the pros and cons of the 3 British and 2 U.S. systems being considered.

2543. **Loftas, T., "At Sea Without a Paddle"**, *New Scientist*, v. 53, no. 789, 30 March 1972, pp. 690-691.

Discusses Britain's lack of a program and the necessary budget for promoting marine technology, and pinpoints the hands-off attitude of the British government and the conservatism of established industry as the reasons for the nonexistence of a pioneering ocean industry in Britain, with the result that the development of North Sea resources is already dominated by large French, Japanese, and American

firms; describes Norway's solution to foreign competition and domination of its territorial waters, and recommends a thorough appraisal of the present situation in Britain along with commitment of development funds by the Department of Trade and Industry.

2544. **"Policy in Doubt"**, *Nature*, **v. 236, no. 5347, 21 April 1972, p. 364.**
Presents comments by British Prime Minister E. Heath questioning the wisdom of having a national science policy, which he fears would have to be too general; other comments concerned the need for achieving the correct balance between pure and applied science, for assuring a sufficient number of qualified scientists and engineers, and for harnessing science and scientific research to fulfill national needs.

2545. **"Science and the Blasted Heath"**, *New Scientist*, **v. 54, no. 798, 1 June 1972, p. 476.**
Describes the strong debate sparked by certain statements made by Prime Minister Heath concerning graduate unemployment in the U.K.: in particular, "Part of the solution lies in arranging, as we are doing in the government service, for scientists to have far wider opportunities than scientific service alone offers, and this practice, I hope, industry will also adopt"; Bill McCall, General Secretary of the Institution of Professional Civil Servants (IPCS), terms the statement "depressingly ill-informed and misguided", claiming that industry, not government, is setting the pace; while Sir William Armstrong, head of the home Civil Service, tried to reassure the IPCS by reminding them of Lord Jellicoe's statement in the House of Lords (in February): "full acceptance of the customer/contract relationship for research and development implies a significant upgrading of the role of the scientists in government".

2546. **"New Agency for Government Computers"**, *New Scientist*, **v. 53, no. 789, 30 March 1972, p. 692.**
Announces the formation of a United Kingdom Central Computer Agency (CCA) under the Civil Service Department (CSD), including the policy and planning functions of the CSD, the Department of Trade and Industry's (DTI) technical support unit, and the purchasing and contract functions of the Stationery Office; DTI retains control of computer R&D, and a White Paper on future computer industry support is expected soon.

URBAN PROBLEMS

2547. **Lewis, J. D., and Lewis, L. (Eds.)**, *Industrial Approaches to Urban Problems: Discussions of Housing, Transportation, Education, and Solid Waste Management Issues*, **Praeger Special Studies in U.S. Economic and Social Development, Praeger Publishers, 1972, 186 pp. ($13.50)**
Presents coordinated, text-type chapters, each by a different distinguished author, based on papers presented at a 1970 AAAS symposium; Part I (5 chapters) discusses housing problems from the standpoints of the private sector, the Federal Government, state government, cities, and labor; Part II (3 chapters) looks at urban transportation ills and describes A. D. Little's Center City Transportation Project; Part III (3 chapters) deals with urban education – primarily industry's role and performance contracting; Part IV (3 chapters) treats solid waste management from an industrial viewpoint.

2548. **Goldmark, P. C., "Tomorrow We Will Communicate to Our Jobs"**, *The Futurist*, **April 1972, pp. 55-58.**
Examines the problems of living in high-density urban areas and proposes a system of communications networks to encourage rural living, and to halt the flow into crowded urban areas in the U.S.; discusses British efforts to encourage the "new rural society", and notes that the greatest deterrent to decentralization is the problem of communication; asserts that "all necessary inventions have already been made" and await only imaginative applications to all needs of the proposed new society.

U.S.S.R.

2549. **Keldysh, M. V.**, *Research Plans of USSR Academy of Sciences*, **JPRS No. 54696, 14**

December 1971; translated from *Nauka i Zhizn'*, no. 8, 1971. (Available from National Technical Information Service, Springfield, Va. 22151. Price: $3.00.)

Describes the Soviet's new 5-year plan (1971-1975) which calls for increased effort and greater progress in scientific development in such areas as mathematics, physics, nuclear physics, power engineering, earth sciences, space research, and social sciences.

2550. **Gurvich, F. G., *Symposium on Research Planning and Management, USSR*, JPRS No. 54461, 11 November 1971; translated from *Ekonomika i Matematicheskiye Metody*, no. 5, September-October 1970.** (Available from National Technical Information Service, Springfield, Va. 22151. Price $3.00).

Presents brief summaries of papers presented, which dealt with such subjects as the role of science in developing a system of optimum economic functioning, the analytical approach to formulation of special subject plans for scientific research institutes, classification of types of planning and forecasting in such institutes, and models for current and long-range planning.

2551. **"U.S.-Soviet Agreement on Exchanges and Cooperation", *International Science Notes*, no. 27, May 1972, pp. 10-12, see also *U.S. Department of State Bulletin*, v. 66, no. 1716, 15 May 1972, pp. 707-713.**

Lists 18 general areas in which the U.S. and Soviet Union will seek to develop mutually beneficial cooperation, including antarctic research; the food, coal, light, and gas and oil industries; electric power (station construction, generation, transmission); man and his environment; oceanography; science information; and transportation; types of cooperation envisaged include exchanges of delegations, specialists, and scientific and technical information; lectures, bilateral seminars, and symposia; and conduct of specialized exhibitions and joint scientific research work.

2552. **"Antarctic Medicine", *Nature*, v. 237, no. 5349, 5 May 1972, p. 5.**

Describes the programs to be conducted at an institute of medical research and practice recently established by the U.S.S.R. at Molodezhnaya observatory in the Antarctic; included are studies on acclimatization, along with microbiological, hygienic, and pathological factors, and the incidence rate of various diseases; on susceptibility to disease and its dependence on various factors; and on psychosomatic factors, including a study of the nervous system under various condition.

2553. **Leighton, L. G., "Another View of Akademgorodok", *Bulletin of the Atomic Scientists*, v. 28, no. 4, April 1972, pp. 37-42.**

Describes the facilities at Akademgorodok, the headquarters of the Siberian Section of the U.S.S.R. Academy of Sciences, including institutes of 20 disciplines, an Institute of Economics and Planning for Industrial Production, a Computer Center, a State Science Library, and a University; examines the problems of attaining the ideals envisioned for the Center: (1) unlimited funds, talent, and opportunity for scientific inquiry; (2) an organic blend of scientific disciplines; and (3) the conduct of both pure and applied research; describes the potential of Siberia for enhancing Soviet economy and the role of Akademgorodok in developing that potential.

2554. **"A Decade of Russian Space Achievement", *Nature*, v. 236, no. 5345, 7 April 1972, p. 256.**

Presents a brief history of the Russian Kosmos satellite series since its inception in 1962 and describes the major achievements: automatic docking (Kosmos-186 and -188), testing the effect of prolonged weightlessness and radiation exposure on dogs (Kosmos-110), and the first experiment on the reception of thermal radioemission from the earth and its atmosphere (Kosmos-243).

2555. **"World's First Water Budget", *Science Policy*, v. 1, no. 2, March/April 1972, p. 3.1.**

Presents statistics on world water resources revealed by the water budget drawn up by hydrologists at the Geography Institute of the U.S.S.R. Academy of Sciences, the main aspects of which are charted on approximately 50 maps; describes the developing countries' urgent need for at least an approximate appraisal of fresh water resources and for hydrological data; from the statistics it is evident that vast quantities of water still remain unused on the larger part of the Earth's surface.

2556. **Afanas'yeva, V. G. (Ed.), *Scientific Management of Society, USSR*, JPRS No. 54482, 15 November 1971; translated from *Nauchnoye Upravleniye Obshchestvom*, no. 4,**

1970. (Available from National Technical Information Service, Springfield, Va. 22151. Price: $3.00.)

Presents selected articles covering such subjects as types of social planning in a socialist society, i.e., socio-economic (including scientific-technical progress), socio-political, and cultural planning; role of forecasting in societal management; societal management and social information; problems of public health administration; and human mental labor and "machine thought" (computers).

WASTE MANAGEMENT

2557. *Radioactive Waste Management Practices in Western Europe*, European Nuclear Energy Agency, Organisation for Economic Co-operation and Development, March 1972, 126 pp. (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave. N.W., Washington, D. C. 20006. Price: $3.25.)

Describes the origin and various types of radioactive wastes and the factors to be considered in establishing policies and planning waste-management operations; reviews current policies and practices, and identifies problems – viz., those having an international impact – which, in the future, may call for modification of practices.

2558. Niessen, W. R., "What We Do With Rubbish", *Technology Review*, v. 74, no. 5, March/April 1972, pp. 10-14.

Describes the magnitude of the solid waste disposal problem, the particular problems posed by the various kinds of wastes, and current status of technology for solid waste management; summarizes the changes in solid waste composition projected to the year 2000, when the quantity to be disposed of will have tripled.

2559. "Disposal – The Solid Waste Dilemma", *NCRR Bulletin*, v. 2, no. 2, April-May-June 1972, pp. 2-15.

Discusses jurisdictional problems encountered in selecting disposal sites, and describes various methods of disposal such as sanitary landfill, composting, and incineration; considers the impact of resource recovery on disposal; concludes that "properly managed and efficient volume reduction – coupled with appropriate resource recovery features and systems – can virtually eliminate environmental concerns . . . [over solid wastes], and offer realistic promise of utilizing the values represented in our solid waste stream".

2560. "Municipal Refuse Collection: An Overview", *Bulletin of the National Center for Resource Recovery, Inc.*, v. 2, no. 1, January-February 1972, pp. 3-31.

Discusses all aspects of the handling and collection of solid waste, including: the direct and indirect costs imposed by antiquated collection methods; the technological developments to reduce the volume and facilitate handling of waste (kitchen disposals, compactor, plastic trash bags); storage space for waste pending collection; manpower problems; and various types of collection systems.

2561. "Sanitary Landfill: Alternative to the Open Dump", *Environmental Science & Technology*, v. 6, no. 5, May 1972, pp. 408-410.

Describes the promise of sanitary landfill, as a clean, efficient, and inexpensive method of solid waste disposal; discusses the various technologies involved in creating a landfill (hydrology, geology, engineering, and sanitation); and examines the problems (e.g., decomposition gas production) and the major obstacles (public opinion) to be overcome; describes typical end uses (benefits), such as ski slopes, ball fields, golf courses, and botanical gardens.

2562. Carroll, J. E., "Down in the Dumps", *Congressional Record*, v. 118, no. 65, 25 April 1972, pp. E4235-4236.

Describes the solid-waste-disposal problem and suggests a legislative program to bring solid waste under control, including granting of Federal subsidies or tax credits as inducements for construction and operation of nonpolluting processing plants, and greater funding for recycling research.

2563. "Resource Recovery Seen as New National Industry", *Waste Note*, v. 1, no. 1, May 1972.

Gives details of a facility designed by the National Center for Resource Recovery,

Inc., to extract metals, glass, and paper products from mixed solid waste; plans call for construction of 12 such facilities (termed the National Resource Recovery Network), each capable of processing 500 tons of refuse daily, with revenue to sustain the operations coming from disposal fees charged municipal or private refuse collectors, and from earnings derived from sale of recovered inorganic materials.

2564. **Moss, F. E., "Recycle or Perish: The Challenge to Business and Mankind",** *ongressional Record,* **v. 118, no. 49, 29 March 1972, pp. S5112-5114.**

Sen. Moss discusses solid waste problems before the National Association of Secondary Materials Industries; attributes the pollution increase since 1946 to population growth (18%), increased wealth (5%), and introduction of nonrecycled products that are built on a new technological base (the overwhelming remainder); deplores Governmental policies that discourage recycling (e.g., imposing higher rate charges on shipping of recycled products and giving tax preferences for the use of virgin resources); makes a strong case for altering such policies in order to foster recycling of resources and control of technology.

2565. **Dominick, D. D., "Reclaiming Our Natural Resources",** *Congressional Record,* **v. 118, no. 55, 10 April 1972, pp. S5691-5692.** (Reprint of address before the National Association of Secondary Materials Industries, March, 1972.)

Describes Environmental Protection Agency activities in the area of solid waste recycling; discusses economic factors that have discouraged recycling; describes 3 recycling projects sponsored by the EPA which emphasize the vast potential for such projects; enumerates measures being considered as recycling incentives, e.g., lowering depletion allowances on virgin materials, price supports on secondary materials, reduced freight rates for secondary materials, direct tax on disposable items that enter the solid waste stream, investment tax credits for industry-purchased recycling equipment, government purchasing of recycled materials, and restrictive legislation to restrain the flow of specific items into the solid waste stream.

2566. **Grinstead, R., "Machinery for Trash Mining",** *Environment,* **v. 14, no. 4, May 1972, pp. 34-42.**

Discusses the technology of various recovery systems – incineration, pyrolysis, composting, cellulose-fiber recovery, and other "sorting" systems; compares the estimated operating cost of each system with the credits for resource recovery; concludes that the price of more economical disposal/recycling systems will mandate not only greater reliance on technology, but also on shrewd marketing; identifies bottlenecks to development of new systems, which include absence of federal support of research into increasing cellulose fiber quantity and quality recovered, and absence of a link between producing and disposal sectors of the economy.

2567. *A Glossary of Solid Waste Management,* **(Revised and Updated), 972, 14 pp.** (Available from National Center for Resource Recovery, Inc., 1211 Connecticut Ave., N.W., Washington, D. C. 20036.)

Briefly defines in nontechnical language some of the most commonly used solid waste terms.

2568. **"Federal Redirections in Solid Waste",** *Environmental Science & Technology,* **v. 6, no. 4, April 1972, pp. 318-320.**

Describes the new emphasis of EPA's solid-waste management activities as outlined by S. Hale, Jr., Deputy Assistant Administrator; the program will focus on using current know-how to improve local management practices to demonstrate that many of the solutions are well in hand and can be readily adopted at the local level without substantial federal assistance; Hale also identified the most significant obstacles to the adoption of progressive management as being financial, institutional, political, and other nontechnological barriers; reviews the economics of resource recovery, which Hale feels will ultimately be the most important aspect of solid-waste management.

2569. **"Paper . . a Recoverable Resource",** *NCRR Bulletin,* **v. 2, no. 2, April, May, June 1972, pp. 16-20.**

Presents statistics on the recycling of wastepaper, with 22% of the paper industries

fiber coming from wastepaper (about 12.2 million tons in 1972), and predicts a wastepaper consumption of 13 million tons in 1973; describes the sources of wastepaper (corrugated containers, pulp substitutes, mixed grades, and newspapers) and its possible uses (as a raw material in the manufacture of new paper products, as the medium for a sanitary landfill or composting operation, or as a nondepletable source of energy).

WEST GERMANY

2570. **"Distribution of German-R&D Personnel"**, *Science Policy*, v. 1, no. 2, March/April 1972, p. 3.4.

Presents a tabulation of 1969 employment figures for R&D personnel in private enterprises and in cooperative and other research institutes, which reveals a continuing trend toward employment of more highly qualified personnel in R&D; percentages increased over 1967 figures for personnel in three categories (research workers and R&D executive staff, engineers, and technicians), while the percentage of supporting personnel decreased.

2571. **"German Reform of Research Board"**, *Science Policy*, v. 1, no. 2, March/April 1972, p. 3.6.

Describes the principal features of the Federal Ministry of Education and Scientific Research plan for reforming its Advisory Service: establishment of an Advisory Board on Education and Research Policy, which will give priority to research policy, but will also advise on questions of education policy in view of their interaction with research; establishment of 4 Boards (Expert Committees) to deal with nuclear research and technology, protective and safety measures against radiation, space research, and data processing and documentation; and establishment of Expert Groups (appointed for periods of 2 to 3 years) as well as Ad Hoc Committees (appointed for shorter periods) when demands for advice on specific problems arise.

2572. **"Germany Plans 5-Year Space Fund Gains"**, *Aviation Week & Space Technology*, v. 96, no. 17, 24 April 1972, pp. 81, 83-84.

Describes how West Germany's $190 million 1972 space R&D budget is divided up (half to development and half to technology advancement, with 2/3 on scientific satellites and 1/3 on applications satellites); predicts increasing emphasis on earth resources and applications satellite programs, with the total space R&D budget going to $300 million by 1976; discusses developments in Germany's domestic television broadcast satellite system and participation in the international programs ERTS, ESRO, and ELDO.

2573. **Hoare, M. R., "Max-Planck-Gesellschaft: A Model for 'Small Science'?"**, *Nature*, v. 237, no. 5352, 26 May 1972, pp. 206-209.

Reviews the history and structure of the70-year-old MPG and its phenomenal growth in the last 10 years to 8000 employees and an annual budget of $150 million in its 52 research units; describes the disciplinary nature of the various institutes (e.g., physics, carbon research, psychiatry, plant genetics, cell chemistry, nutrition, law, education, patents, criminology, etc.), their relationship with universities and university research, and their preference for "small science" over high-cost "big machine" science; presents recommendations of the structure commission to enhance collective decision making, limit powers of directors, and increase interest in social and environmental problems.

2574. **"Germany on the Brink of Educational Reform"**, *OECD Observer*, no. 58, June 1972, pp. 10-14.

Sums up the main aspects of the debate on the reform of education in Germany between examiners and the German Delegation, joined by members of the OECD Committee on Education; reports the general policy conclusions that the German education system is "ill-adapted to the demands of the existing German economy with its highly mobile technological base and corresponding social dynamism", and that the system "should be reconceived as a system which would be open and flexible, preparing the population for a mobile, active role in Germany's technological social-economy"; suggests increased student participation in policymaking

and management; criticizes the continued dominance of tenured full professors in German universities, and suggests revision of Germany's vocational educational system.

Publications Screened For This Issue

AEC News Releases (weekly) U. S. Atomic Energy Commission; Division of Public Information; Washington, D.C. 20545; No charge

American Scientist (bimonthly) 155 Whitney Ave.; New Haven, Conn. 06510; $9.00/yr in U.S.; $9.50/yr elsewhere; $1.75/single issue

Astronautics and Aeronautics (monthly) Received with membership to American Institute of Aeronautics & Astronautics; 1290 Ave. of the Americas; New York, N.Y. 10019; Dues $35.00/yr

Aviation Week & Space Technology (weekly) P.O. Box 503; Hightstown, N.J. 08520; $20/yr for qualified personnel; $30 others; $1.00/single issue

BioScience (semimonthly) American Institute of Biological Sciences; 3900 Wisconsin Ave., N.W.; Washington, D.C. 20016; $24.00/yr

Bulletin of the Atomic Scientists (monthly, except July and August) Circulation Department; 1020-24 E. 58th St.; Chicago, Ill. 60637; $8.50/yr in U.S.; $9.00/yr in Canada and Pan American Union; $9.50/yr elsewhere

Chemical & Engineering News (weekly) American Chemical Society; 1155 16th St., N.W.; Washington, D.C. 20036; $8.00/yr

Chemical Technology (monthly) American Chemical Society; 1155 16th St., N.W.; Washington, D.C. 20036; $18.00/yr nonmembers

Congressional Record (daily when Congress convenes) Superintendent of Documents; U.S. Government Printing Office; Washington, D.C. 20402; $45.00/yr; $3.75/mo; 25 cents/copy

Embassy of Switzerland Bulletin (triannually) Office of the Scientific Counselor to the Swiss Embassies in Washington, D.C., and Ottawa, Canada; Contact Mr. G.-A. Grin, Scientific Counselor, Embassy of Switzerland; 2900 Cathedral Ave., N.W.; Washington, D.C. 20008

Environment (monthly except Jan/Feb & Jul/Aug) Committee for Environmental Information; 438 N. Skinker Blvd.; St. Louis, Mo. 63130; $10.00/yr in U.S.; $12.00/yr elsewhere

Environmental News (irregular) Office of Public Affairs; Environmental Protection Agency; Washington, D.C. 20460; No charge

Family Planning Perspectives (quarterly) 515 Madison Ave.; New York, N.Y. 10022; Free to qualified personnel

Foreign Affairs (quarterly) 58 East 68th

St.; New York, N.Y. 10021; $10.00/yr

Fortune (monthly) 541 North Fairbanks Court; Chicago, Ill. 60611; $16.00/yr U.S. possessions, and Canada; $25.00/yr elsewhere; $2.00/single issue

Futures (quarterly) Futures IPC (America) Inc.; 300 East 42 St.; New York, N.Y. 10017; $30.00/yr, $22.50 for individuals; $7.50/single issue

Futurist (bimonthly) World Future Society; P.O. Box 19285, 20th Street Station; Washington, D.C. 20036; $7.50/yr; $1.25/single issue; Institutional membership $100.00/year

Harvard Business Review (bimonthly) Subscription Service; 108 Tenth St.; Des Moines, Iowa 50305; $12.00/yr in U.S. and Canada; $15.00/yr elsewhere

Impact of Science on Society (quarterly) Unesco Publications Center; P.O. Box 433; New York, N.Y. 10016; $4.00/yr; $1.25/single issue

Industrial Research (monthly) Circulation Department; Industrial Research Building; Beverly Shores, Ind. 46301; No charge to qualified persons in the U.S.; $9.00/yr to qualified persons abroad; higher rates to nonqualified persons

Innovation (monthly except Jul and Dec) Fulfillment Manager; 265 Madison Ave.; New York, N.Y. 10016; Nonmembers: $35.00/yr in U.S. and Canada; $45.00/yr elsewhere; $5.00/single issue; single issue $7.50 to nonsubscribers or nonmembers

International Science Notes (intermittent) U.S. Department of State; Bureau of International Scientific and Technological Affairs; Washington, D.C. 20520; No charge

LaRecherche (11 issues/yr, in French) 4 Place de l'Odeon; 75-Paris-6^{e}; France; 75 francs/yr in France; 90 francs/yr elsewhere

Minerva (quarterly) 59 St. Martin's Lane; London WC2N4JS; England; $7.50/yr by air in U.S.; $8.00/yr by air in Canada; £2.50/yr in U.K. and elsewhere

Monthly Catalog of Government Publications (monthly) Superintendent of Documents; U.S. Government Printing Office; Washington, D.C. 20402; $7.00/yr in U.S.; $8.75/yr elsewhere

Mosaic (quarterly) U.S. Government Printing Office; Washington, D.C. 20402; $2.50/yr in U.S.; $3.25/yr elsewhere; 70 cents/single issue

Nature (weekly) 711 National Press Bldg.; Washington, D.C. 20004; $48.00/yr in U.S.

New Scientist (weekly) IPC Magazines; 66-69 Great Queen St.; London WC 2E 5DD, England; $20.00/yr in U.S. and Canada (by air); £6.00/yr elsewhere; 25 p/single issue

News Report (NAS, NRC, NAE) (10 issues/yr) 2101 Constitution Ave., N.W.; Washington, D.C. 20418; No charge

Physics Today (monthly) American Institute of Physics; 335 East 45th St.; New York, N.Y. 10017; $7.00/yr in U.S. and possessions, Canada, and Mexico; $10.50/yr in Europe, Mid East, N. Africa (by air); $8.50/yr elsewhere

Policy Sciences (quarterly) American Elsevier Publishing Co.; 52 Vanderbilt Ave.; New York, N.Y. 10017; $17.00/yr; $5.25/single issue

Public Policy (quarterly) Harvard University Press; 79 Garden St.; Cambridge, Mass. 02138; $9.00/yr in U.S.; $10.00/yr elsewhere; $2.75/single issue

R&D Management (3 issues/yr) Basil Blackwell; 108 Cowley Road; Oxford OX41JF; England; £5.00 ($12.00)/yr; £2.00 ($4.80)/single issue

Research Management (bimonthly) P.O. Box 51; Red Banks, N.J. 07701 $14.00/yr in U.S. and Canada; $16.00/yr elsewhere; $3.00 single issue

Research Policy (quarterly) North Holland Publishing Company; P.O. Box 211; Amsterdam; The Netherlands; 91 Dfls/yr (about $28.50)

Saturday Review (weekly) 380 Madison Ave.; New York, N.Y. 10017; $12.00/yr

Science (weekly) American Association for the Advancement of Science; 1515 Massachusetts Ave., N.W.; Washington, D.C. 20005; $20.00/yr in U.S.; $23.00/yr Americas; $25.00/yr overseas

Science and Government Report (24 issues/yr) P.O. Box 21123; Washington, D.C. 20009; $25.00/yr in U.S.; $35.00/yr elsewhere (by air)

Science Forum (bimonthly) University of Toronto Press; Toronto 5, Ontario; Canada; $9.00/yr; $1.75/single issue

Science News (weekly) Subscription Dept.; 231 West Center St.; Marion, Ohio 43302; $10.00/yr in U.S.; $12.00/yr in Canada and Mexico; $13.00/yr elsewhere

Science Policy (bimonthly) Science Policy Foundation; Benjamin Franklin House, 36 Craven St.; London WC2N 5NG, England; £6.40/yr in U.K.; $17.00/yr elsewhere; $22.00/yr airmail; libraries and institutions higher

Science Review (Philippine) (bimonthly) Science Planetarium; Herran-Taft Ave.; P.O. Box 3596; Manila, Philippines; No charge

Science Studies (quarterly) Macmillan Journals Ltd.; Little Essex St.; London WC 2R 3LF; England; $13.00/yr in U.S. and Canada; £5.00/yr elsewhere

Scientific American (monthly) 415 Madison Ave.; New York, N.Y. 10017; $10.00/yr in U.S. and Canada; $1.00/single issue (European subscriptions from International Distributors; Vlagstraat 128, Borgerhout 2200, Belgium)

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Technology and Culture (quarterly) 5750 Ellis Ave.; Chicago, Ill. 60637; $12.00/yr

Technology Review (nine issues/yr) Room E19-430; Massachusetts Institute of Technology; Cambridge, Mass. 02139; $9.00/yr in U.S.; $10.00/yr elsewhere

The Center Magazine (bimonthly) Fund for the Republic, Inc.; 2056 Eucalyptus Hill Road; Santa Barbara, Calif. 93108; $15.00/yr Associate Membership dues include 6 issues/yr

The Hastings Center Report (bimonthly) Institute of Society, Ethics and the Life Sciences; 623 Warburton Ave.; Hastings-on-Hudson, N.Y. 10706; Received with Associate Membership in the Institute; Dues $15.00/yr, $7.00/yr students

The OECD Observer (bimonthly) OECD Information Service; Chateau de la Muette; 2 rue Andre Pascal; F 75 Paris 16^{e}; France; $3.50/yr (£1.15, F15.00, FS13.00, DM10.50); 80 cents/issue (£0.27, F3.50, FS3.00, DM2.50)

The Public Interest (quarterly) P.O. Box 542; Old Chelsea Office; New York, N.Y. 10011; $7.50/yr

The Sciences (monthly) 2 East 63rd St.; New York, N.Y. 10021; $5.00/yr; 50 cents/single issue

U.S. Department of Commerce News (irregular) Public Information Office; National Oceanic and Atmospheric

Administration; Washington, D.C. 20230; No charge

Vital Speeches of the Day (semimonthly) City News Publishing Company; P.O. Box 606; Southold, N.Y. 11971; $10.00/yr; 50 cents/single issue

Washington Science Trends (weekly) Trends Publishing, Inc.; National Press Building; Washington, D.C. 20004; $50.00/yr

Waste Not (monthly) National Center for Resource Recovery Inc.; 1211 Connecticut Ave., N.W.; Washington, D.C. 20036; no charge

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